POPULAR SCIENCE

MONTHLY

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25¢ August, 1951

Aerial Bus Climbs Mountain

PAGE 114

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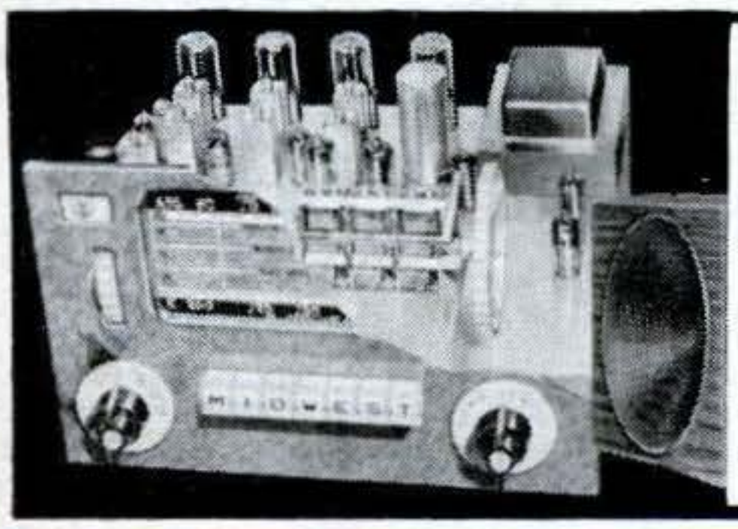

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Founded 1872, Vol. 159: No. 2

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Godfrey Hammond, PUBLISHER · Stephen P. Glennon, ADVERTISING DIRECTOR

EDITORIAL OFFICES: 353 Fourth Avenue, New York 10, N. Y.
ADVERTISING OFFICES: NEW YORK — 353 Fourth Avenue; CHICAGO—360 North Michigan Avenue; DETROIT—820 Book Building; SAN FRANCISCO—681 Market Street; PORTLAND (ORE.)—907 Terminal Sales Building; CLEVELAND—328 Citizens Building; LOS ANGELES—1052 West 6th Street.

Popular Science Monthly is published monthly at 353 Fourth Avenue, New York 10, N. Y., by Popular Science Publishing Co., Inc., Godfrey Hammond, President and Treasurer; R. C. Wilson, Stephen P. Glennon, Vice-Presidents; F. W. Briggs, Secretary. Entered as second-class matter Dec. 28, 1918, re-entered as second-class matter July 26, 1948, at the Post Office in New York, N. Y., under the act of March 3, 1879; additional entry as second-class matter at Dayton, Ohio. Entered as second-class matter at the Post Office Department, Canada. Printed in U.S.A. Copyright, 1951, by Popular Science Publishing Co., Inc. All rights reserved in the United States, Great Britain, and in all countries participating in the International Copyright Convention and Pan-American Copyright Convention. Yearly subscriptions to United States, its possessions and Canada, $3.00 (2 years, $5.50; 3 years, $7.50); foreign countries $1 per year extra. Subscribers must notify us of change of address four weeks before next publication. Be sure to give both old and new addresses, including zone numbers. Vol. 159, No. 2.

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With spare-time study, he paved a

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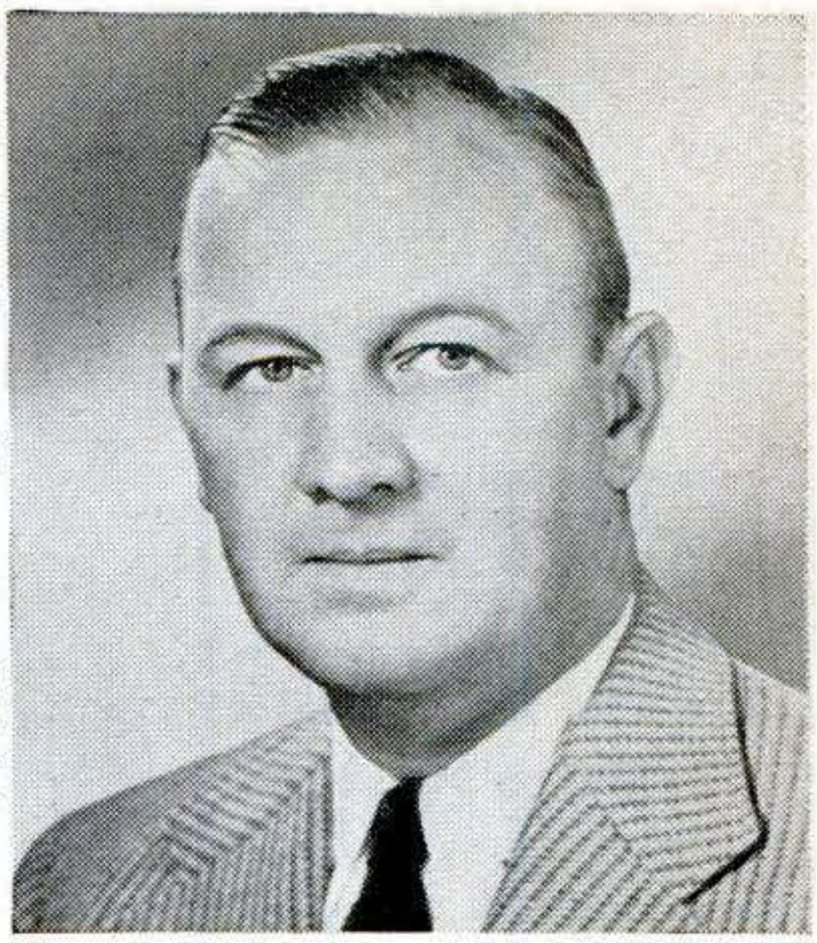

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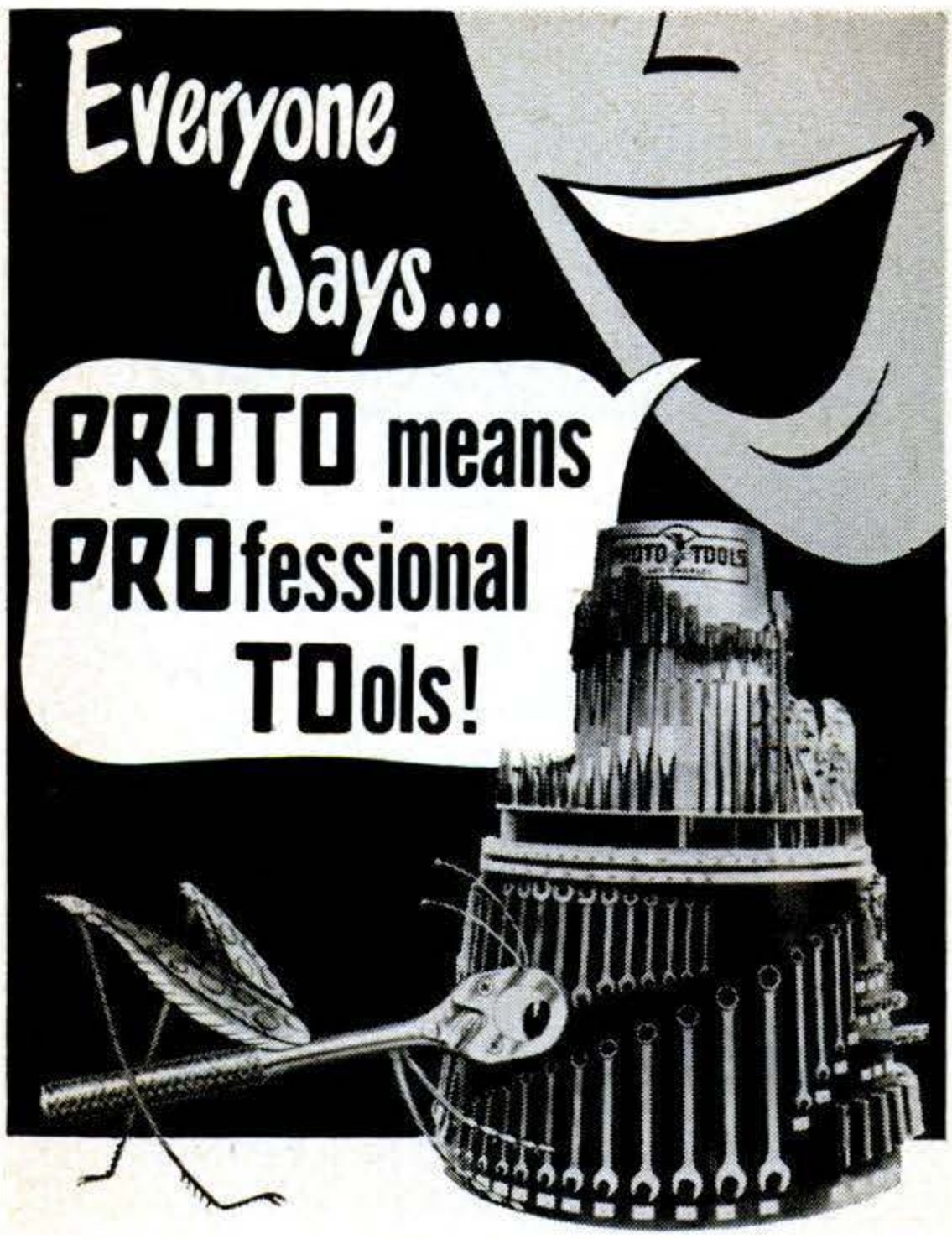

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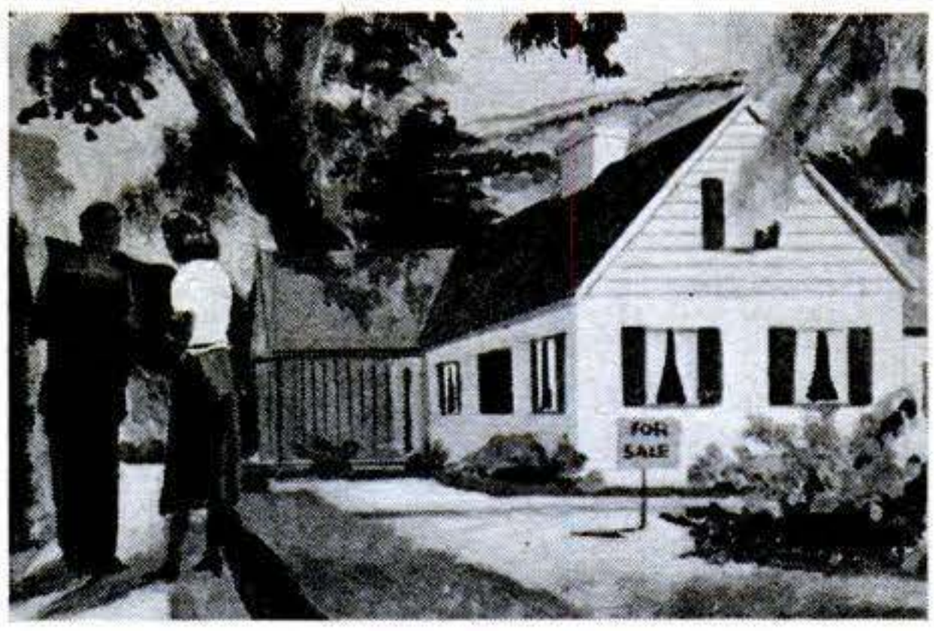
NEXT MONTH . . .

How Good Is the House?



That's the $64 question when you go shopping for a home. A seven-page check list in the September issue takes you from cellar to attic, pointing out what to look for to make sure you get your dream house and not a house-owner's nightmare.

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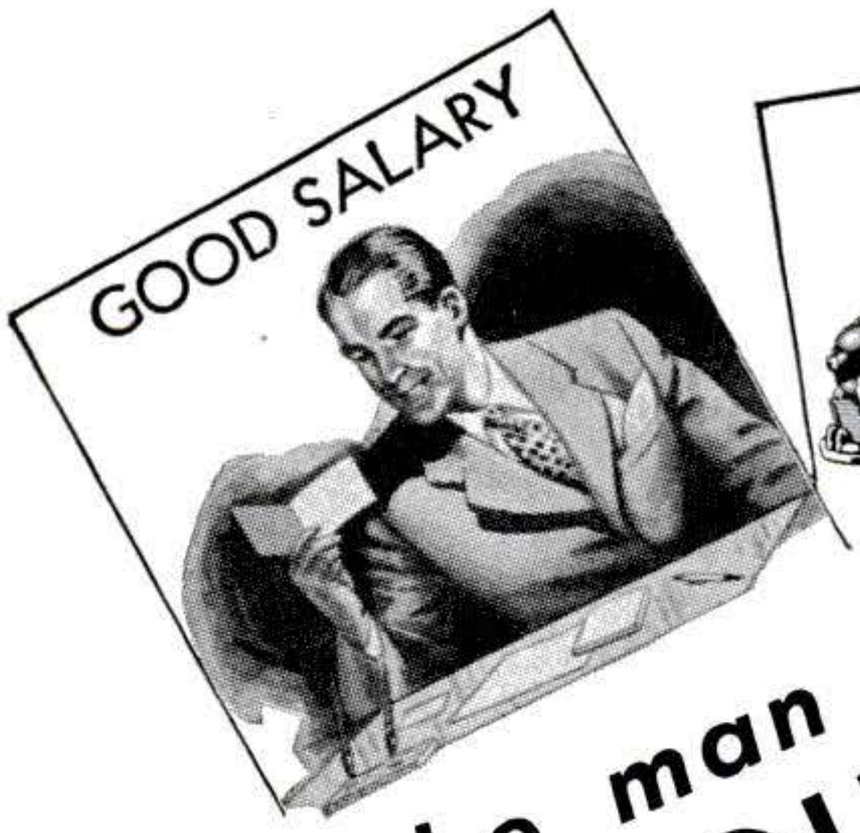
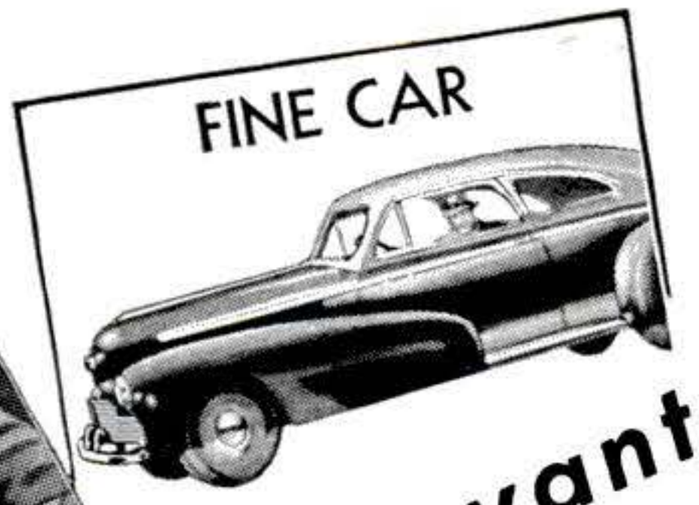
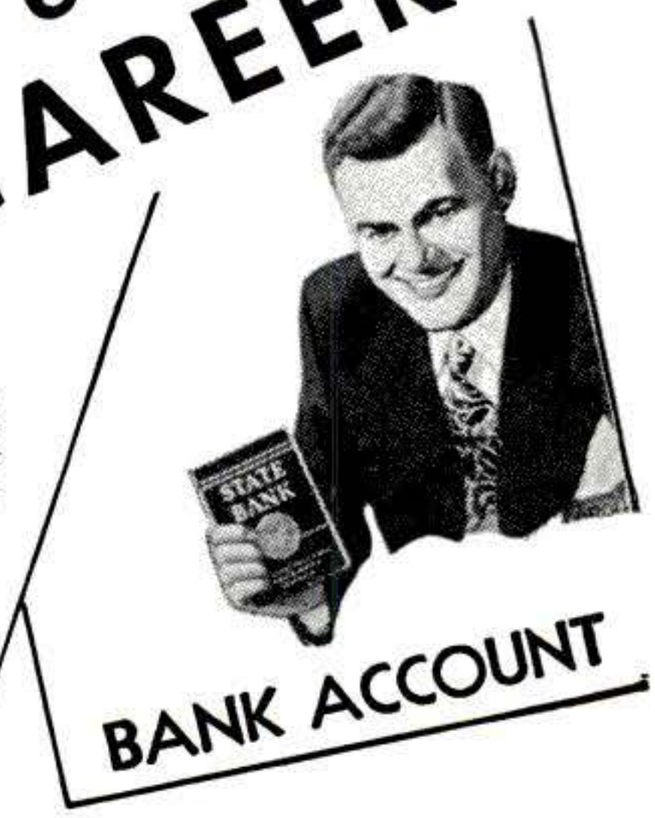




To the man who wants to enjoy an ACCOUNTANT'S CAREER



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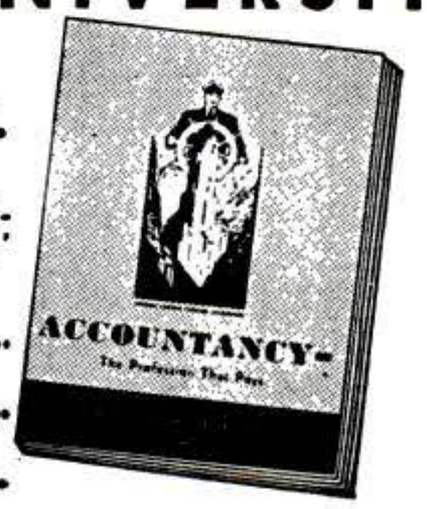

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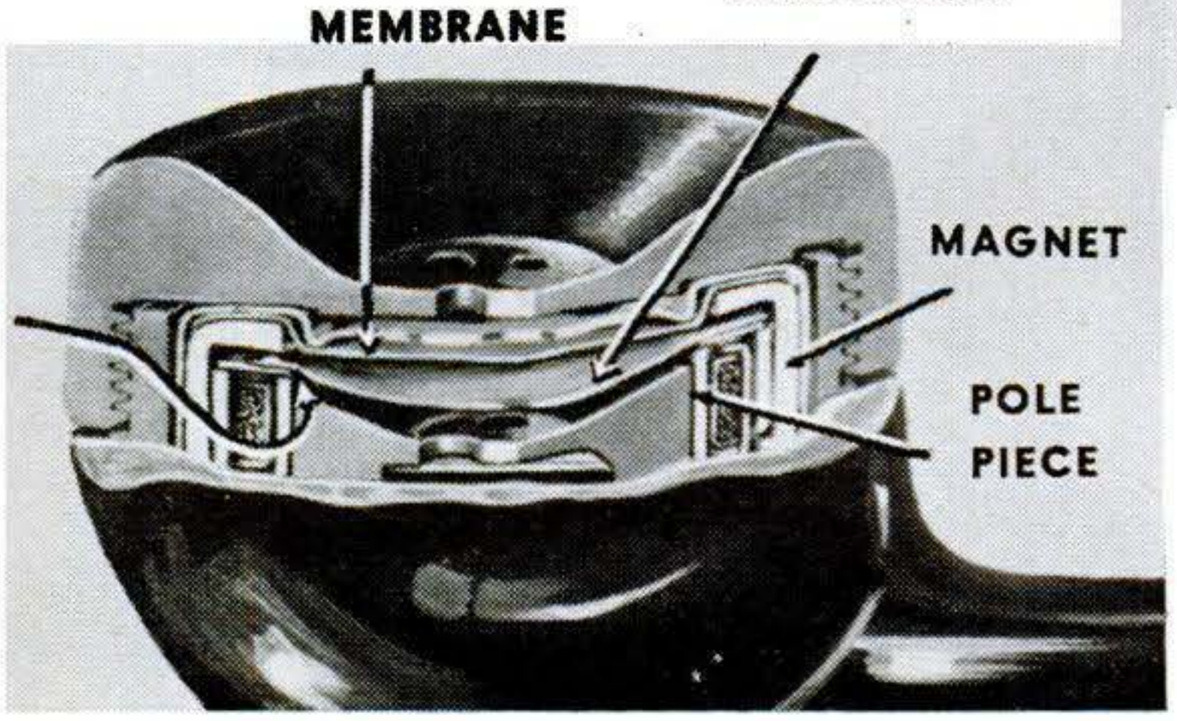
Easy on the ear



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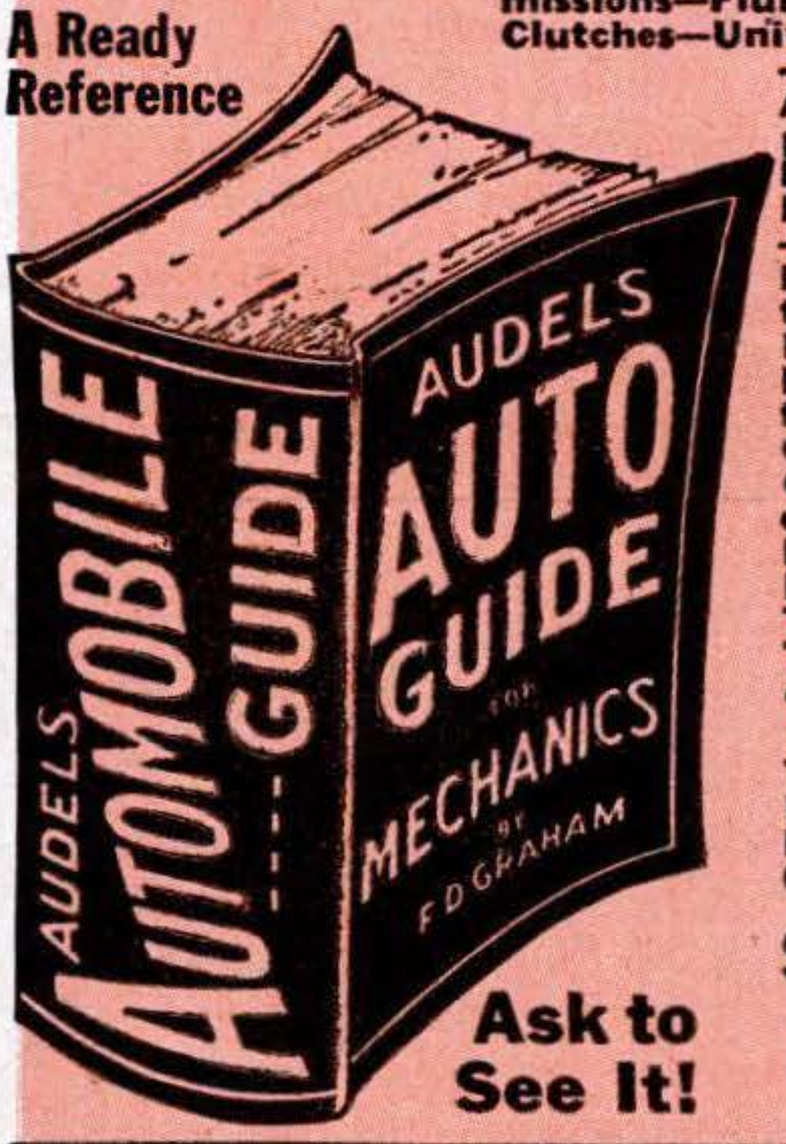

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Letters

Seen Any Good Signs?

What's the cleverest traffic sign you have come across? Here are some that I've encountered:

DRIVE CAREFULLY, DON'T INSIST ON YOUR RITES.

GO SLOW, THIS IS A ONE-HEARSE TOWN.

AMOS HENDRICKS, New York City

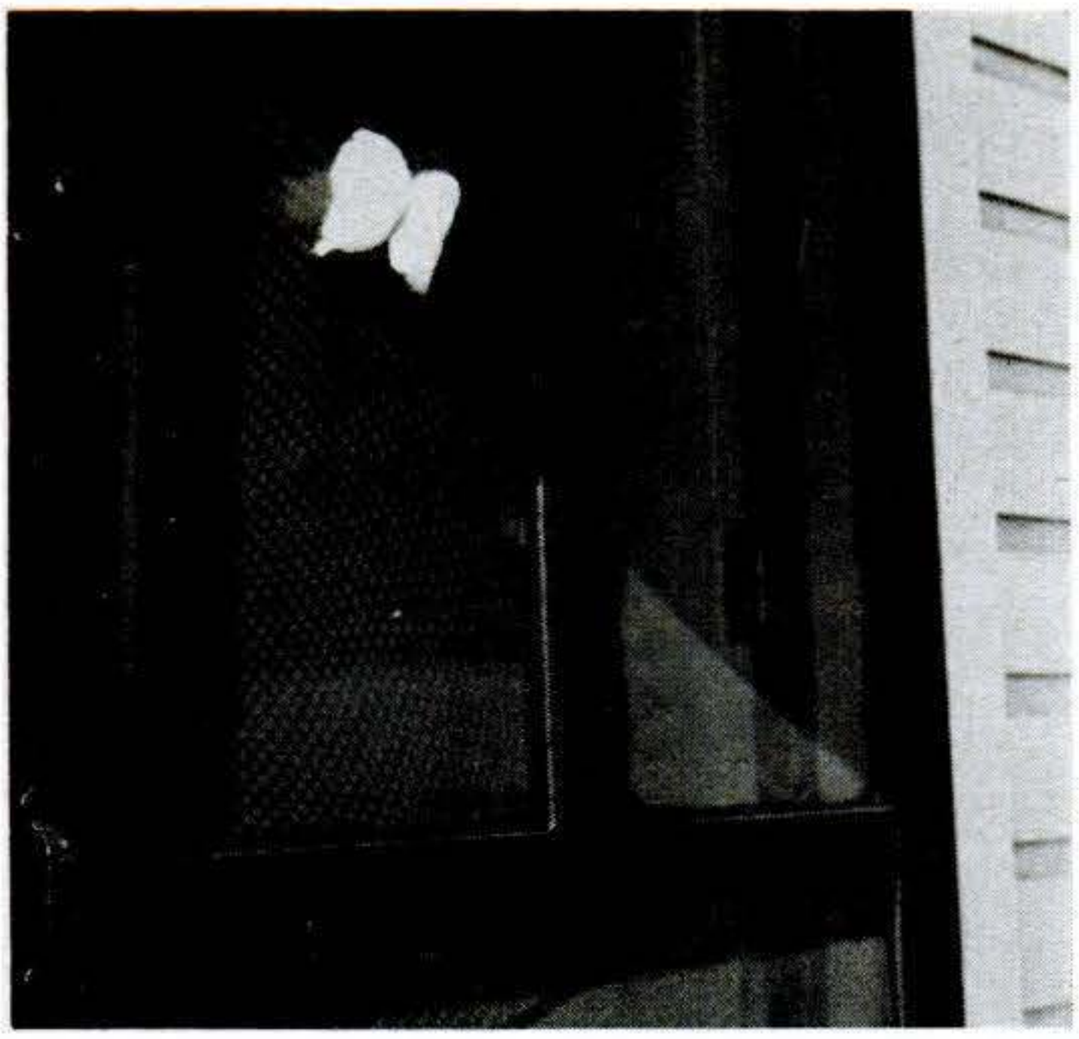
Understandable, but Not Too Simple

I have been a constant reader of POPULAR SCIENCE for eight or nine years and enjoy your magazine very much. You have an adequate coverage of all the latest improvements, and it is written so a person can understand it. But, on the other hand, you do not try to make it too simple, and that is good.

RICHARD E. REDNICK, Ossining, N. Y.

Does Cotton Stop Flies?

While on vacation in the South, I saw many screen doors and windows with wads of cotton on them, and was told that the cotton keeps the flies away. Nobody seems to know why.



JOSEPH P. STURMGARD, Los Angeles

The Bureau of Entomology of the U. S. Department of Agriculture has tested the use of cotton on screen doors as a fly repellent and found "no basis whatever to the belief that it is in any way effective."

Hot About Starters

Am getting pretty disgusted with all the beefing about some cars having a starter that works in conjunction with a key, while others have not. Anytime I get too lazy to exert

about six ounces of pressure on a convenient little button with my pinky, then just living wouldn't be worth the effort. Incidentally, these automatic switches can be a mechanical headache if you have trouble when you're far away from dealer service. Is the tremendous labor saving provided by these switches worth it?

W. R. SUTHERLAND, Mill Valley, Calif.

Lazy-Man's Repair

Some time ago my 12-year-old radio—in which I had never even replaced a tube—up and died. Yesterday, after letting it collect dust on a shelf for several months, I plugged it in again—and it worked fine. A neighbor tells me that radios, like people, rejuvenate themselves with simple rest. Could that be?

ELMER JOHNSTON, Sioux City, Ia.

Rest doesn't help but a change in operating conditions often does. Moving a set on or off a shelf may jog a faulty contact or eliminate dust or moisture. Wires and tube filaments sometimes act like thermostats: they open when hot, close again when they cool off. Leaky condensers are famous for self-healing, but a leaky condenser is more likely to produce distorted sound than a dead set.

Cold Compress

I work on Pike's Peak, and as you probably know, a car boils easily at high altitudes if it isn't driven right. I've seen a lot of people badly burned removing a cap from a steaming radiator. Even those standing back away from the car a few feet when someone else removed the cap.

The simplest and safest way, and also best for the engine, is to run water over the top

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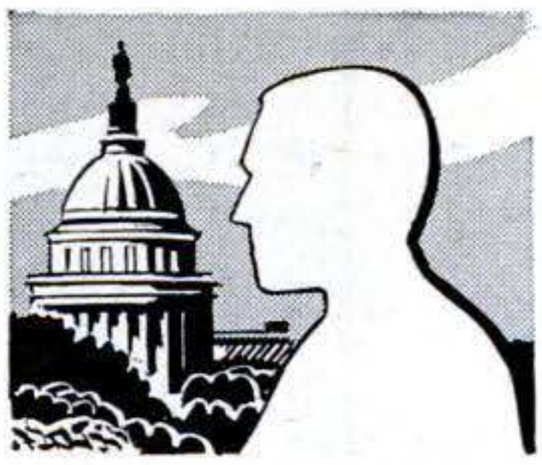
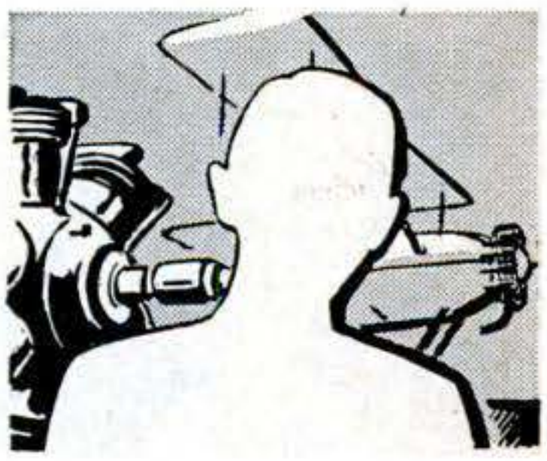
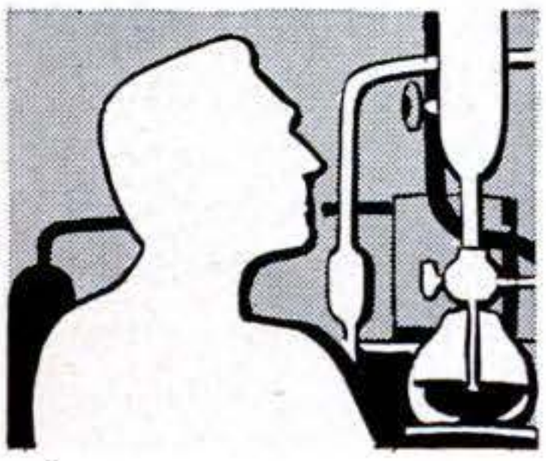


CHAIRMAN of an important national defense board.

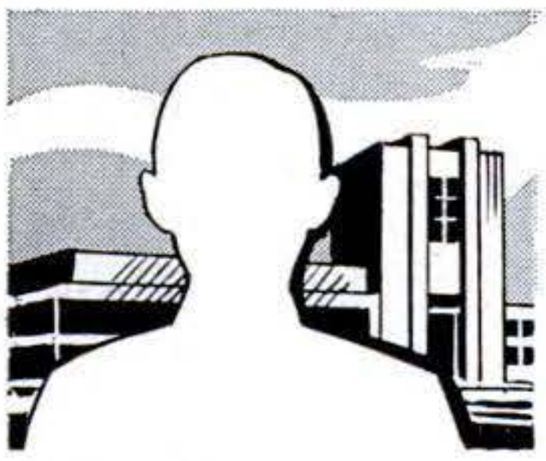
INVENTOR of a well-known U. S. Army rifle.



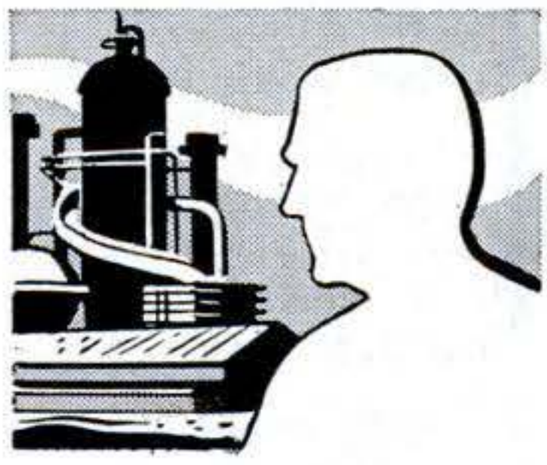
DESIGNER of a famous aircraft engine.



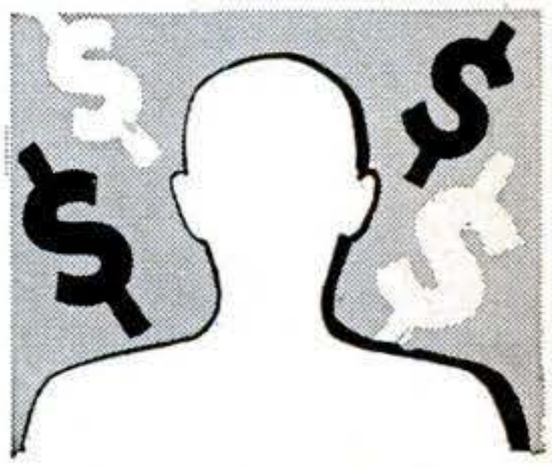
CHEMICAL director of nationally known research laboratory.



ENGINEER in charge of a famous company's engineering laboratory.



GENERAL MANAGER of one of America's largest chemical companies.



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tank of the radiator while the engine is running at a fast idle. This will quickly condense the steam and cool the engine so that the radiator cap can be removed safely and without loss of water.

The same thing applies to gasoline when a car vapor-locks. We put a wet rag over the fuel pump. This will condense the vapor back to liquid and quickly stop the trouble.

GEORGE FIELDER, Colorado Springs

Poor Diet for Battery

The May issue of PS suggests examining the radiator water in an automobile periodically by drawing it up into a hydrometer.

It would be wise to add a footnote that, once a hydrometer is used for this purpose, it should never again be used as a battery hydrometer. Even though the water does not look rusty, it will have a high (for water) concentration of iron in solution. Even a small amount of iron introduced into a battery cell will drastically reduce its life.

ALLAN N. GLENNON, Annapolis, Md.

Cars by the Pound

Wilbur Shaw's report on the "little" cars in your May issue [p. 82] ends by listing how much each costs per pound. That seems to me a silly ground for comparison. Is he saying that because a car weighs more you get more? Or that the heavier the automobile the better? A heavier car has its advantages—and disadvantages. But it's the engineering that counts.

EDWIN BERRY, Sacramento, Calif.

Silly or not, cost per pound is one measuring stick the automobile industry uses in comparing car values.

Lead Wool Anchors Screws

One of your contributors suggested recently using steel wool as packing around screws when driving them into plaster walls [March, p. 212]. Because steel rusts so quickly, I don't see that such an anchor would have much permanence. However, I have used *lead* wool quite successfully for anchors in plaster, glazed tile, concrete, quarry tile, and brick. The lead wool should be tamped compactly into the hole and then pilot-drilled. It will be found to hold very

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I send you parts to build this transmitter

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This is just part of the equipment my students build. You keep all parts I send.

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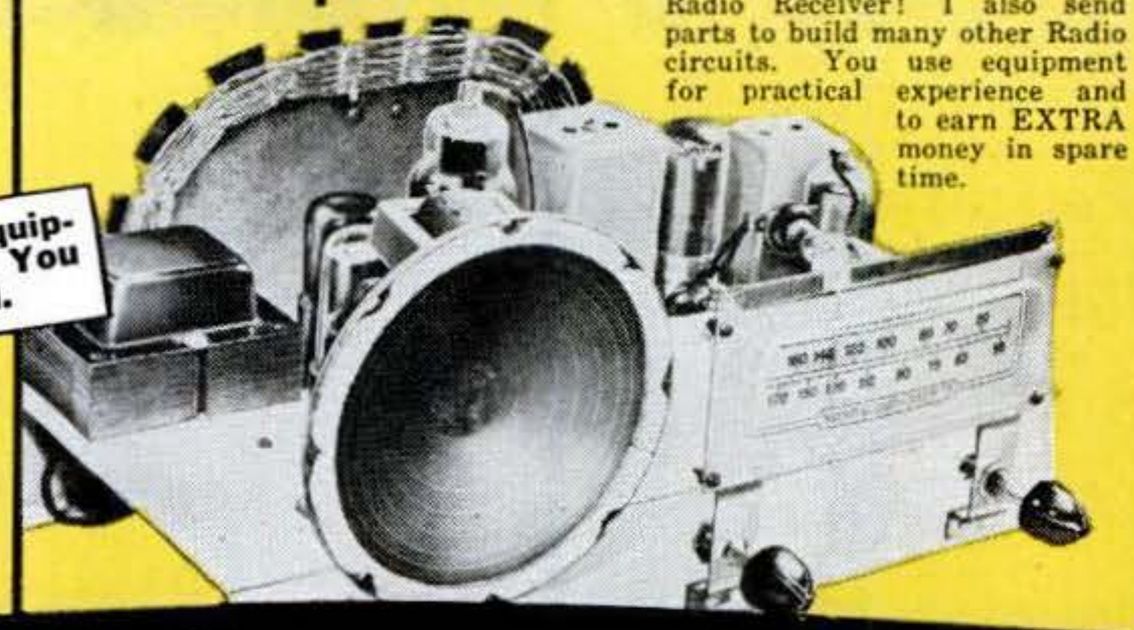

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J. E. SMITH, President
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"When halfway through the NRI course, I made $5 to $8 a week fixing sets in my spare time. Am now selling and installing Television sets and antennas."—E. J. STREITENBERGER, New Boston, O.

"My first job was operator with KDLR, obtained for me by your Graduate Service Dept. I am now Chief Engineer of Police Radio Station WQOX. I never hesitate to endorse NRI."—T. S. NORTON, Hamilton, Ohio.

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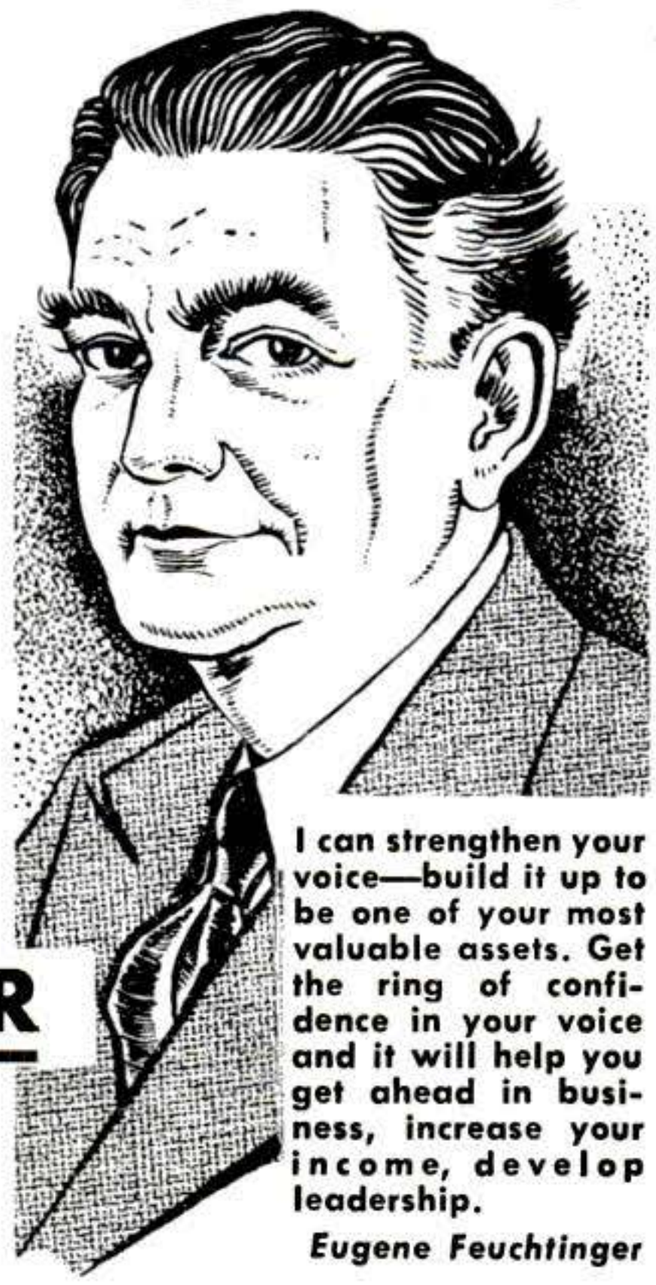

I can strengthen your voice—build it up to be one of your most valuable assets. Get the ring of confidence in your voice and it will help you get ahead in business, increase your income, develop leadership.

Eugene Feuchtinger

Add *controlled* strength to your voice and people will listen when you talk. A stronger voice may make you more interesting, more persuasive, more poised. What you say will have more importance, when your voice is full-toned, because people generally respect a BIG voice.

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My age is:

well. Sheet lead may be cut into strips, rolled and beaten into tight plugs, and driven into holes to form similar anchors.

P. W. JAMES, Ypsilanti, Mich.

More About Railroading

As an ex-railroader, I was gratified to run across "Highballing with a Camera" in the June PS [p. 177]. You just can't get the railroad out of the railroader, but it seems to me this fine set of photos and explanatory text should be thrilling to the layman as well. Hope to see others in this field.

CHARLES D. DULIN, Kansas City

For another railroad story—a report on a ride in the locomotive of the world's fastest train—see page 79.

Shooting with Gas

I found your article in March PS on Russian weapons interesting. However, you said that the Tokarev and Garand were the only gas-operated rifles used in quantity in World War II. The Germans had a gas-operated rifle a lot like the Tokarev. I have one, a souvenir from the last fracas. The gas piston is on the top of the barrel, and it has a magazine that holds 10 rounds.

C. L. SHEAFFER, Mt. Holly Springs, Pa.

Handling an Ax

The well illustrated article on rehandling a hammer in your May issue [p. 172] is very instructive. But there's a point about rehandling an ax I've never seen explained. How can you drive the handle into the eye, since an ax handle isn't cut square at this end?

ANDREW VENA, Philadelphia

To avoid splitting the end, simply saw off a little to leave a square tip where the hammer strikes.

Coming Up

I need some good tips on how to seal up my car so water won't leak in around the doors, through the cowl vent, and into the trunk.

WAYNE K. HAZELRIGG, Chicago

We'll give you a complete article on the subject next month.

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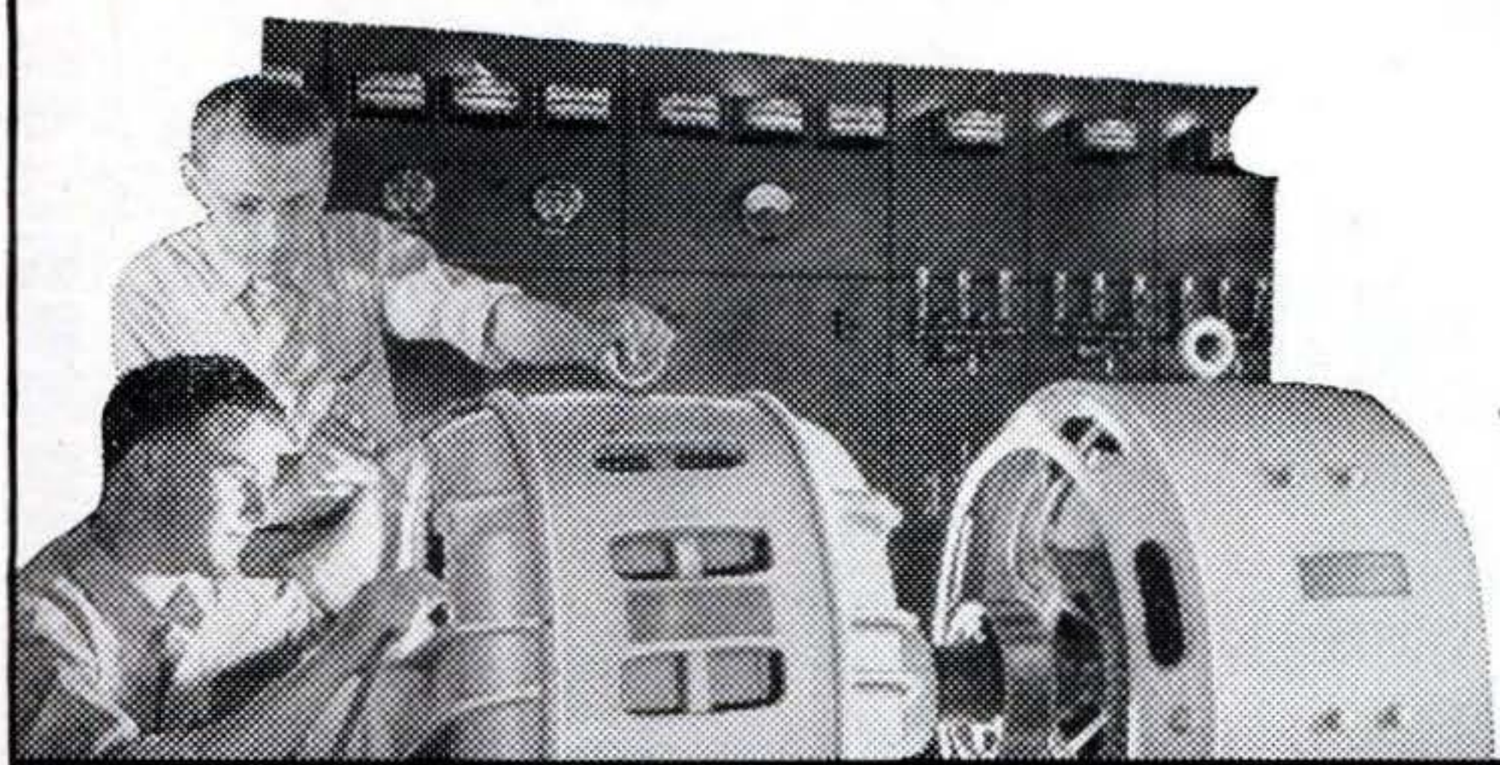
IN ELECTRICITY

On Real:



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(Shown at left—Instructor explaining operation and testing of a large Motor Generator in our A.C. Department.)

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PUBLIC ADDRESS Systems

(Right—Instructor helping students check the wiring and trace circuits of television receivers.)

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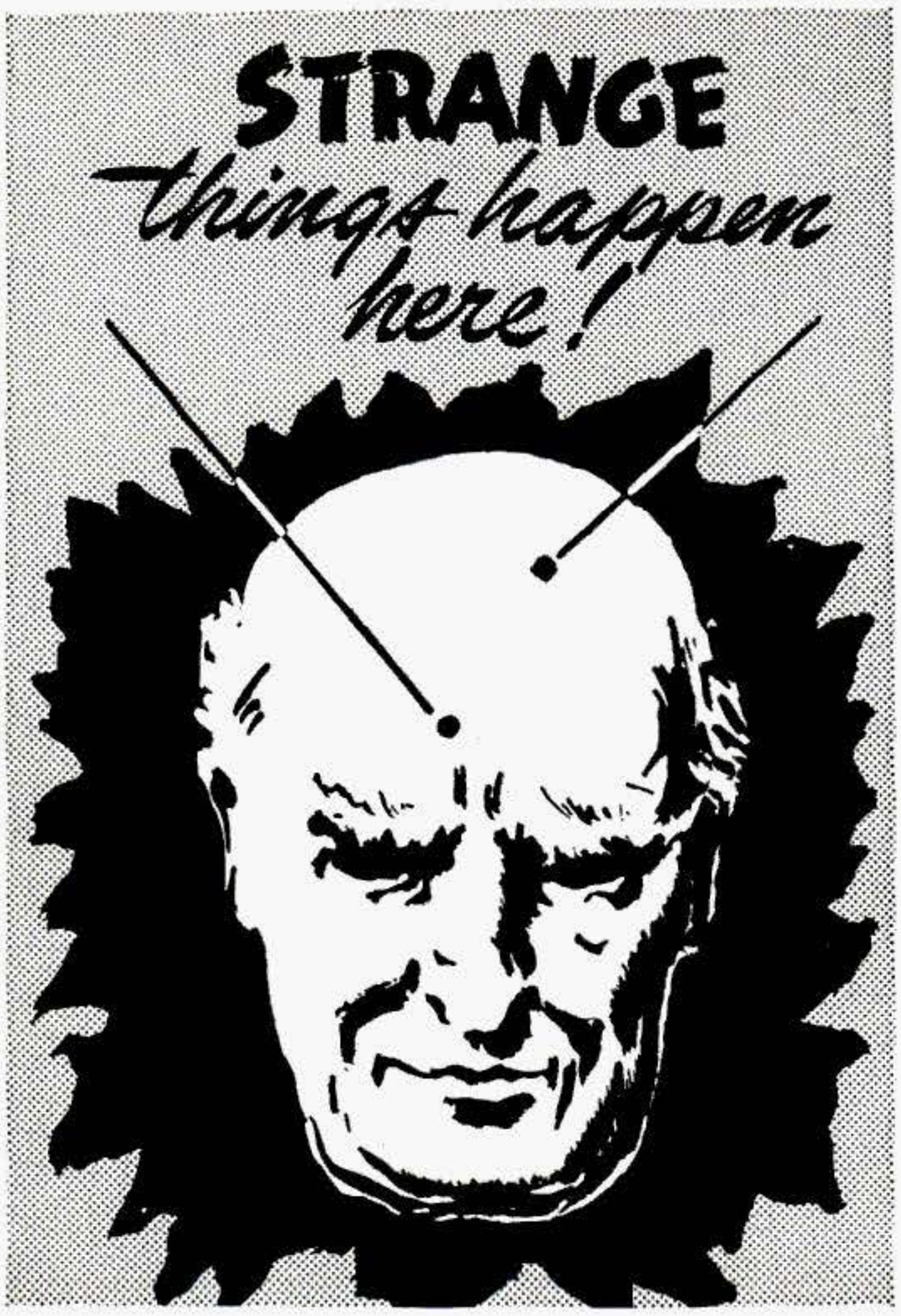

The Dark Continents of Your Mind

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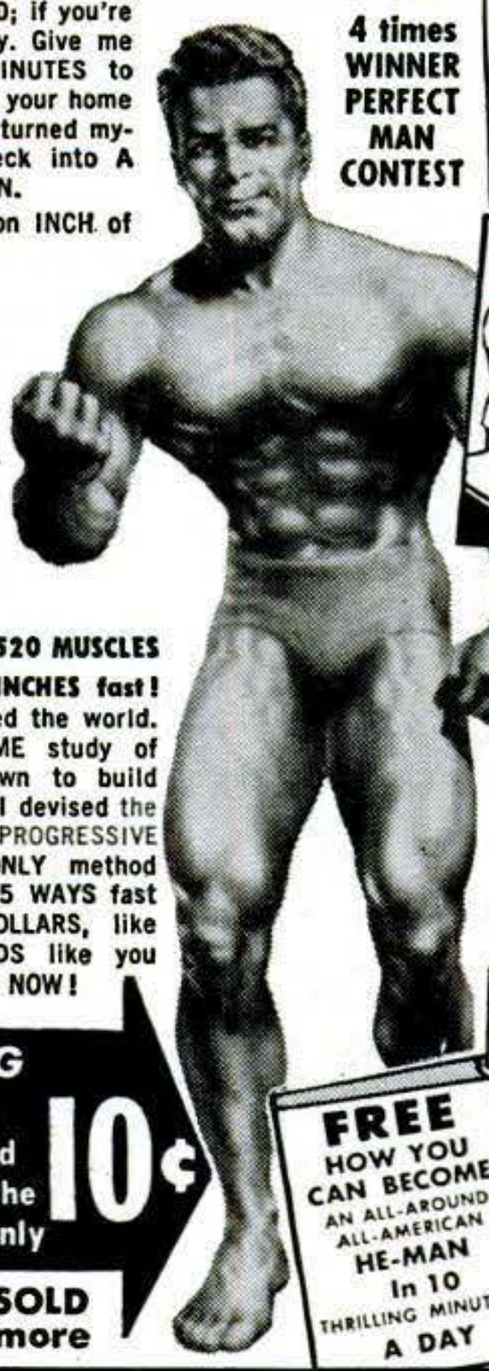

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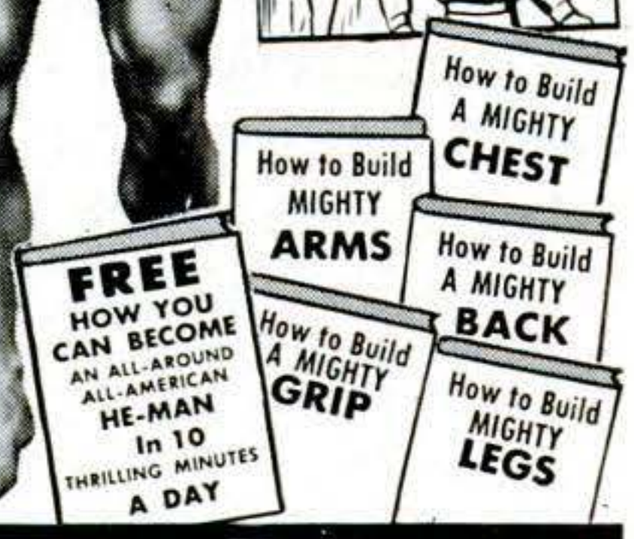

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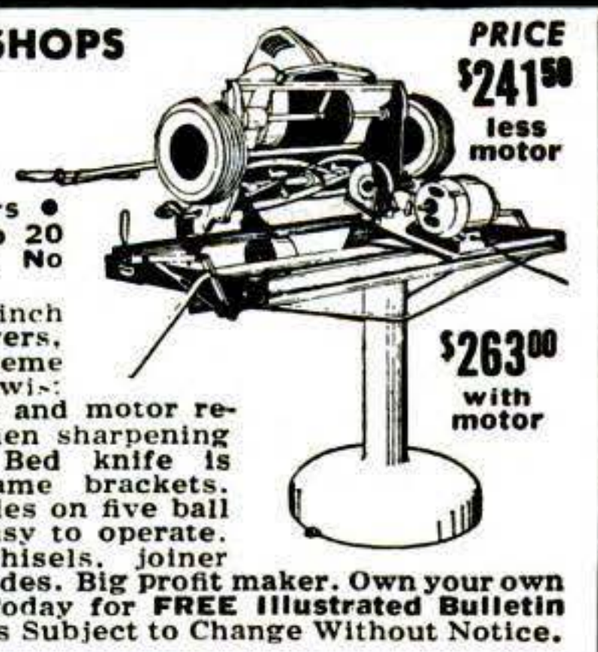

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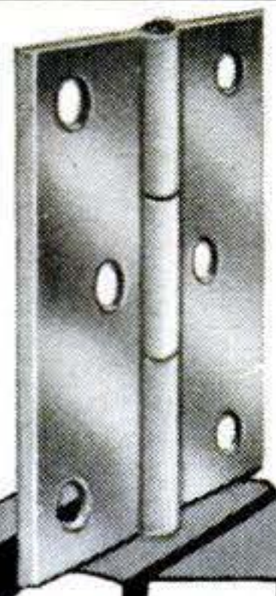

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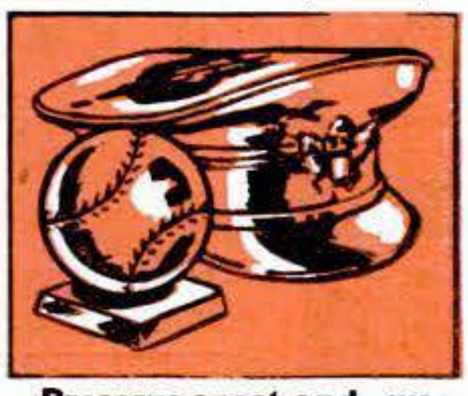

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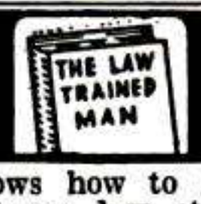

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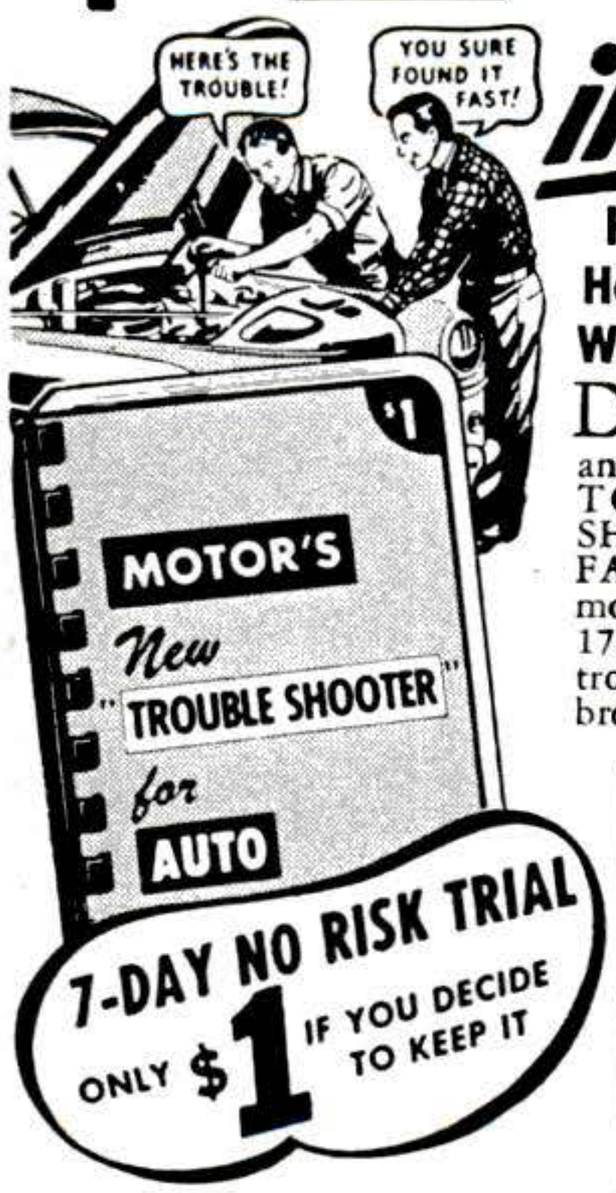

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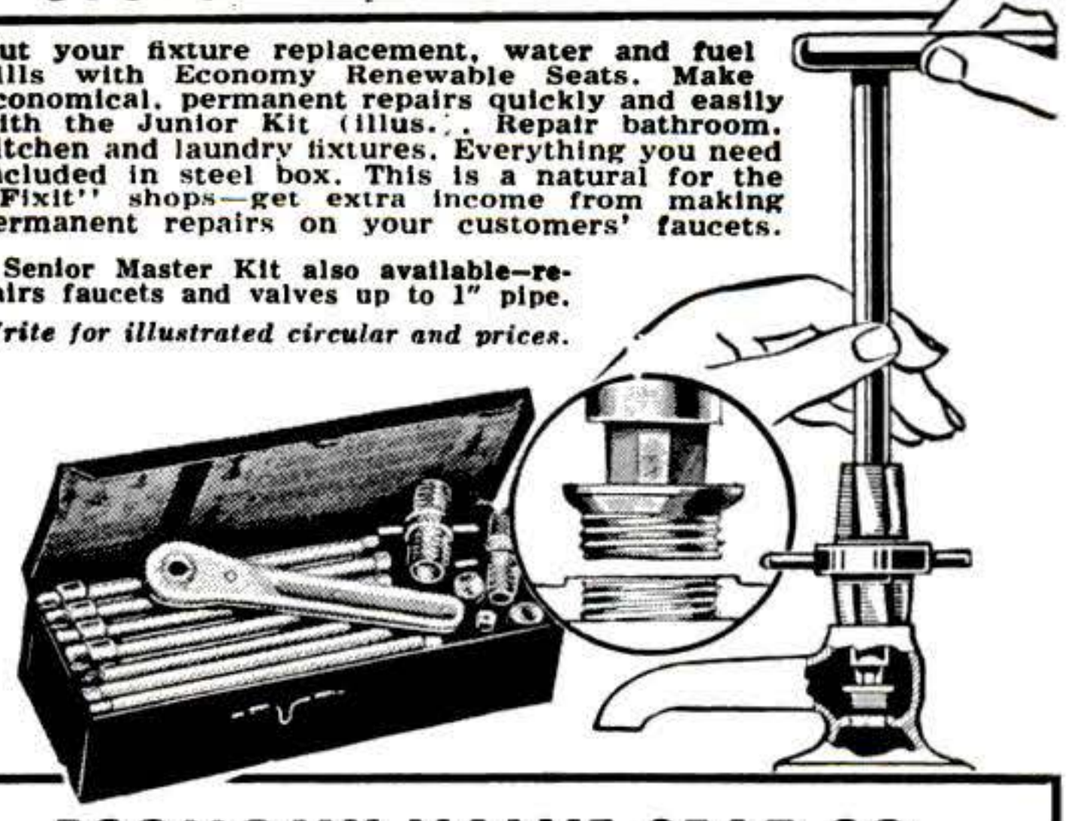

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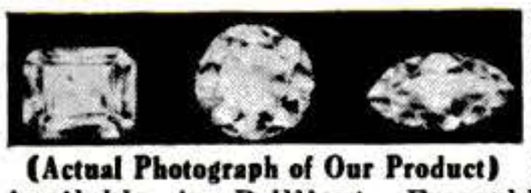

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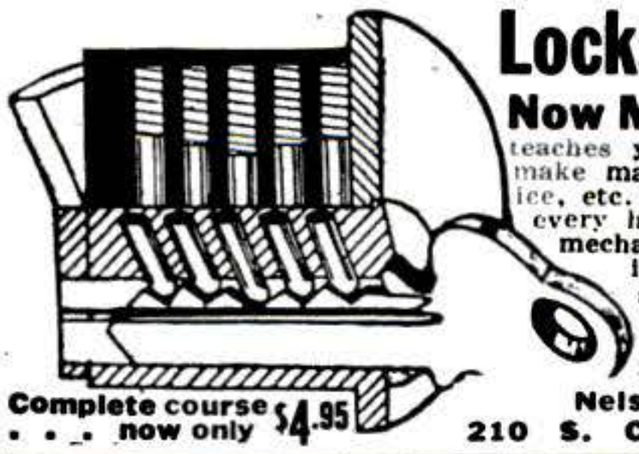

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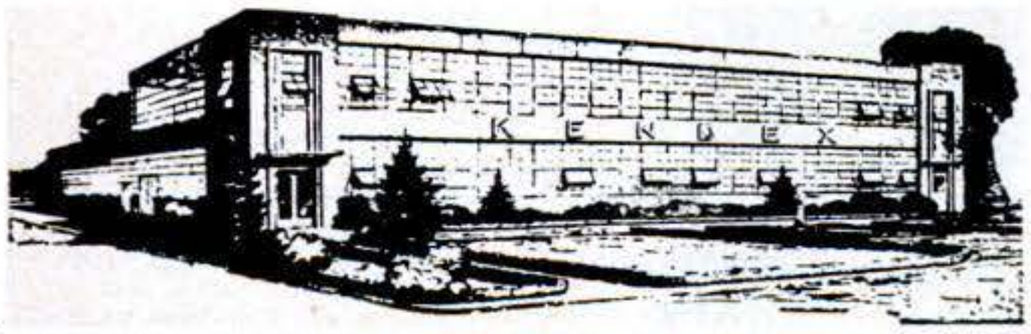

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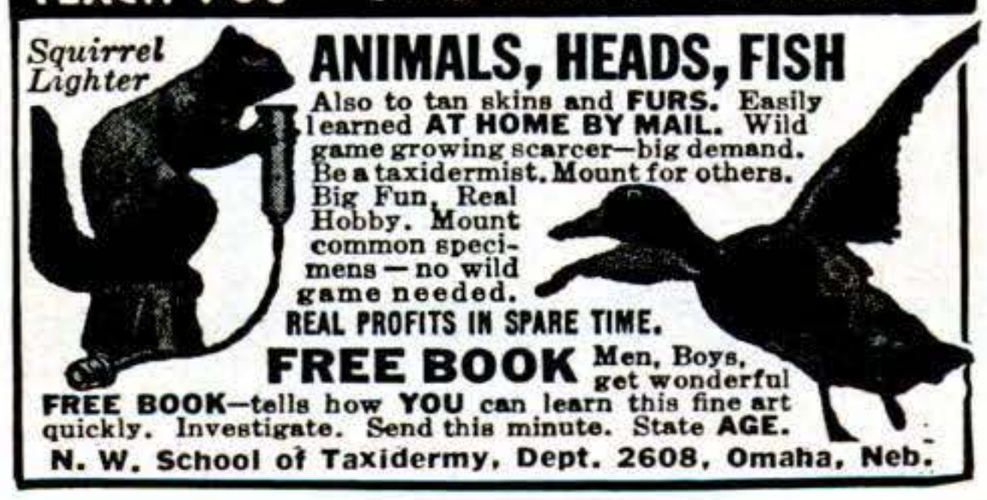

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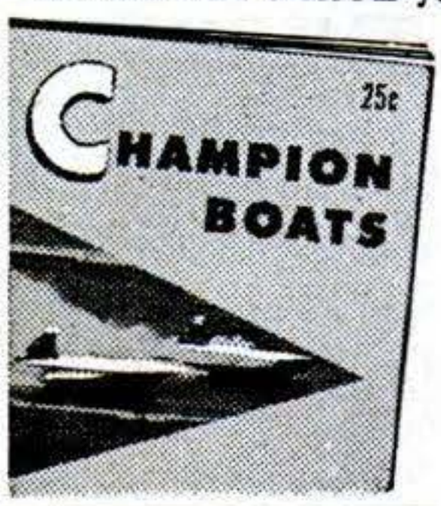

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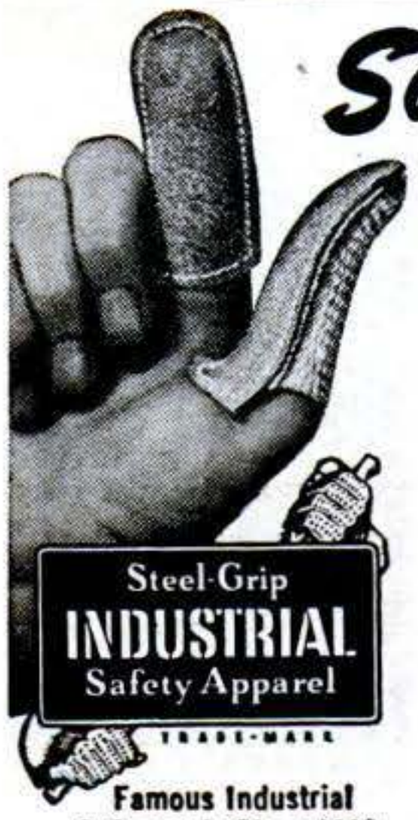

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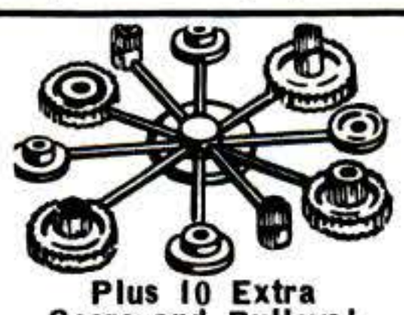

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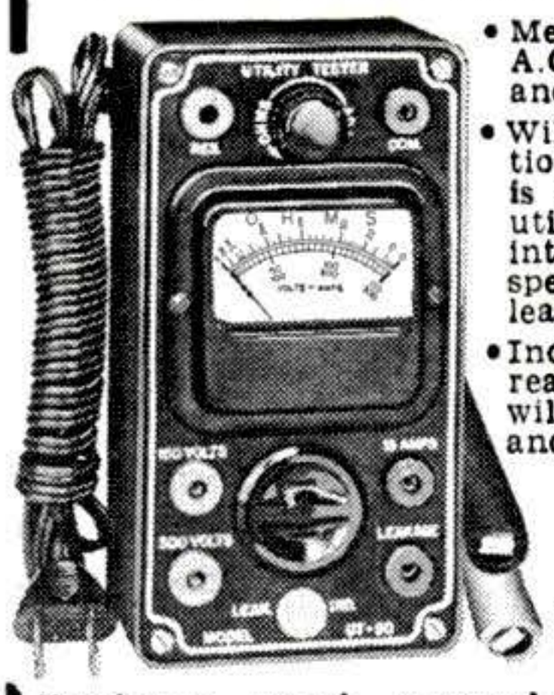

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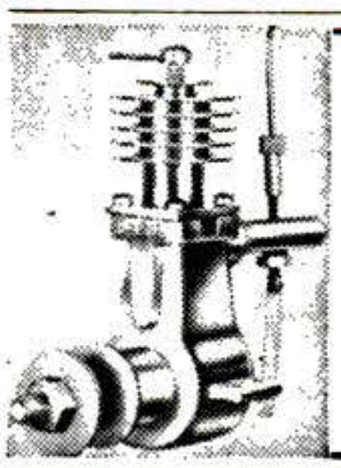

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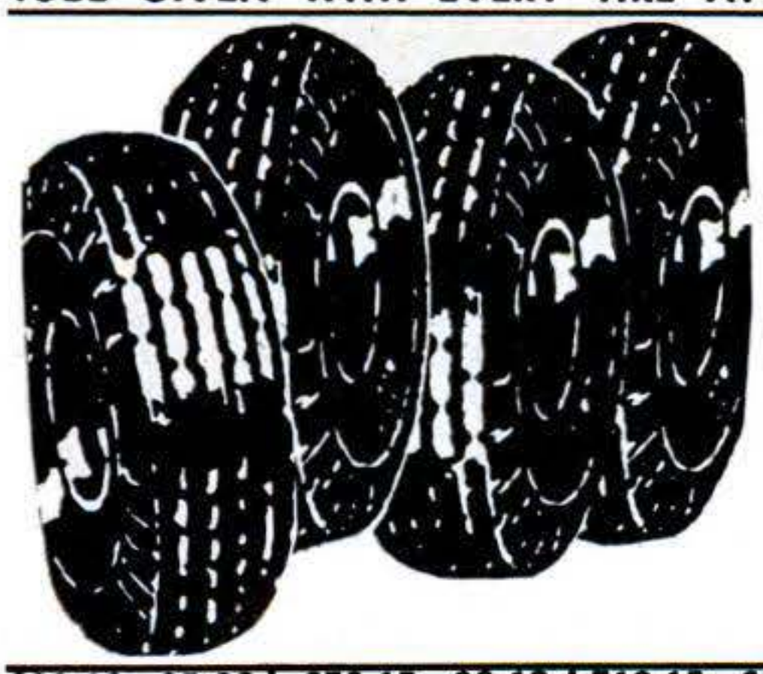

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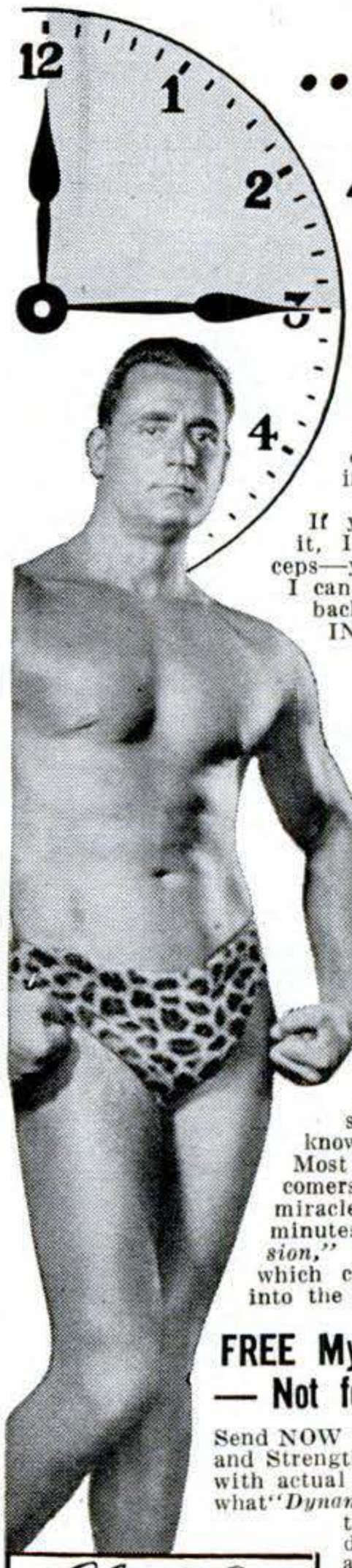

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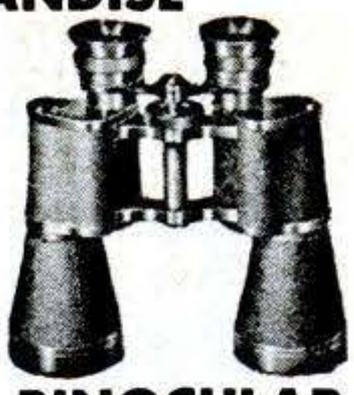

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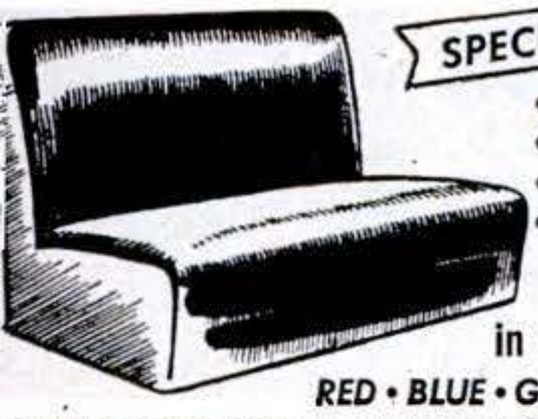

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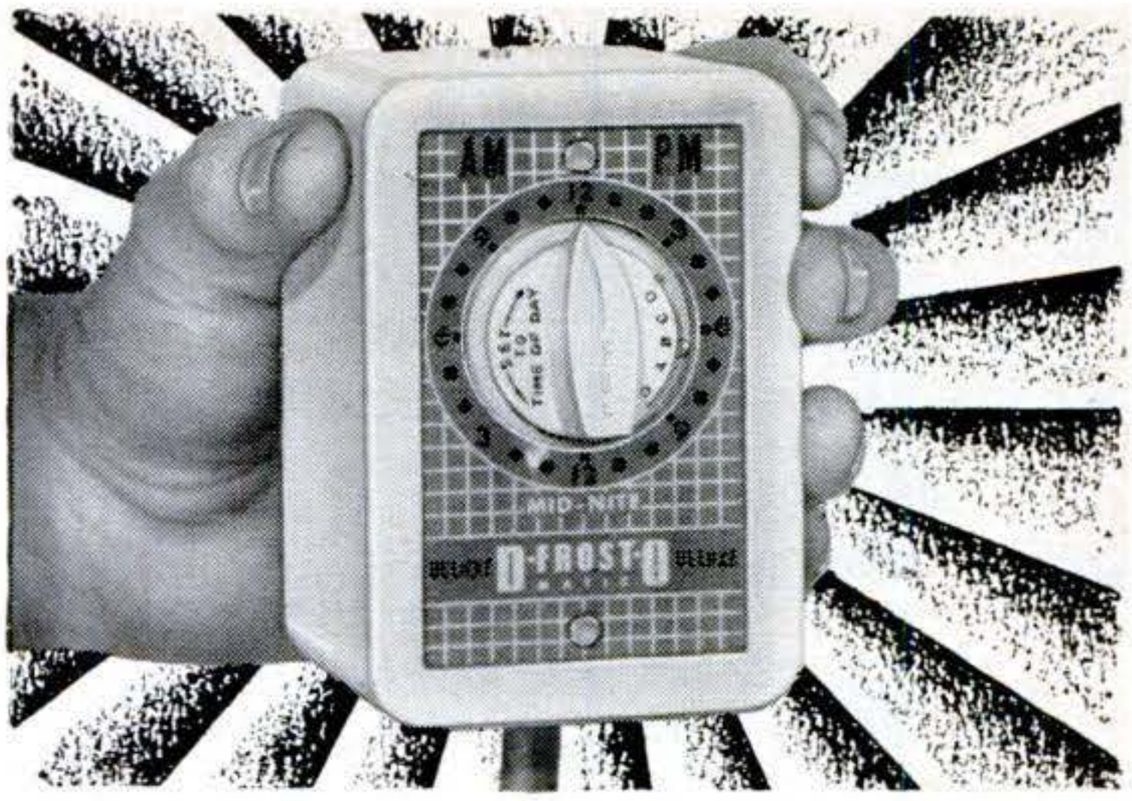

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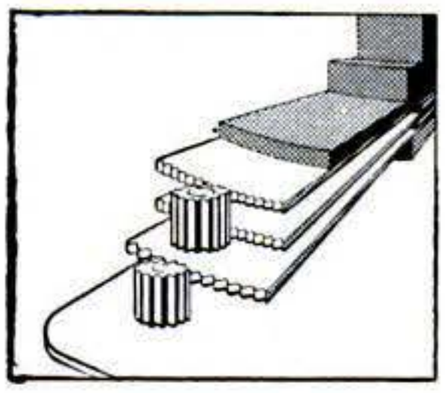

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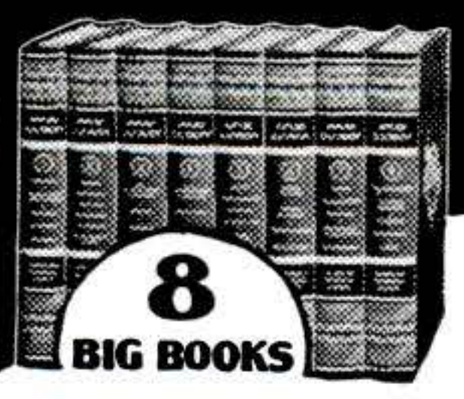

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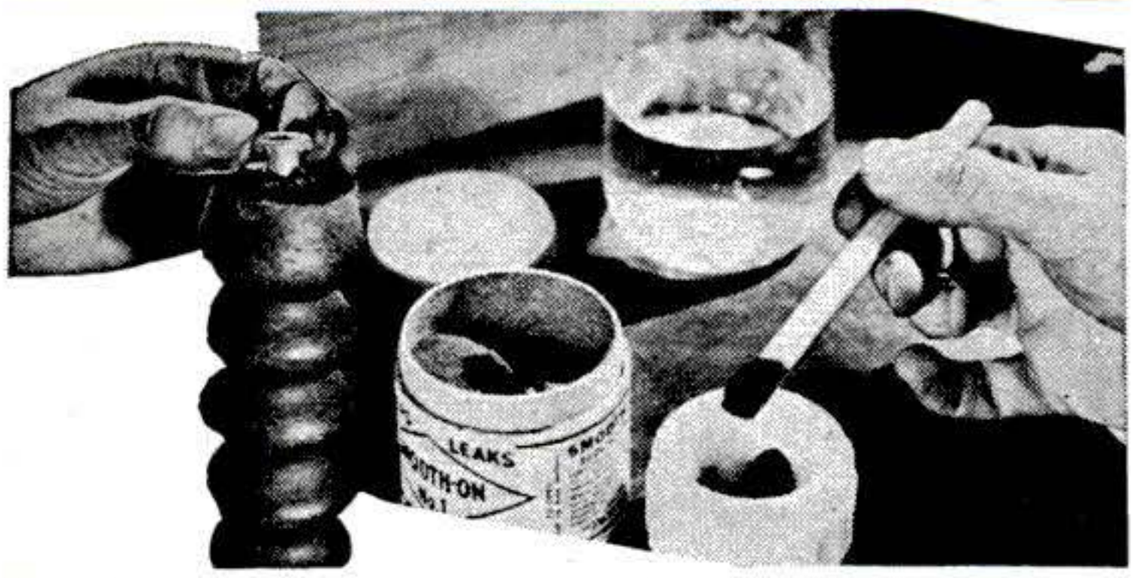

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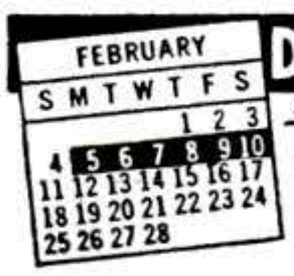

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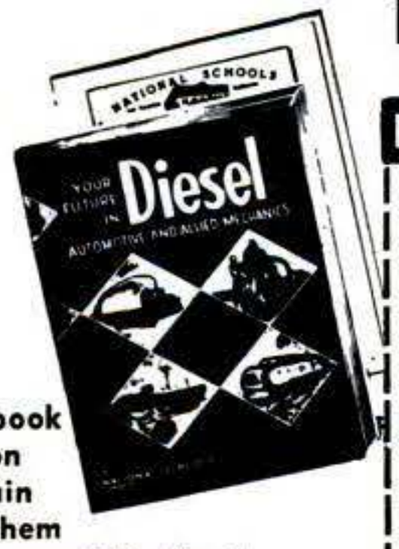

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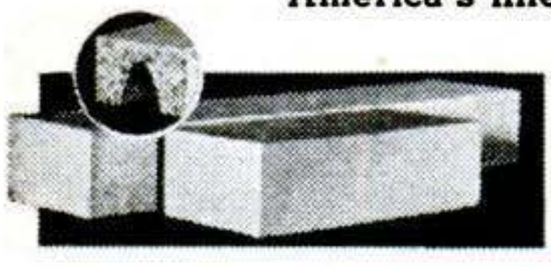

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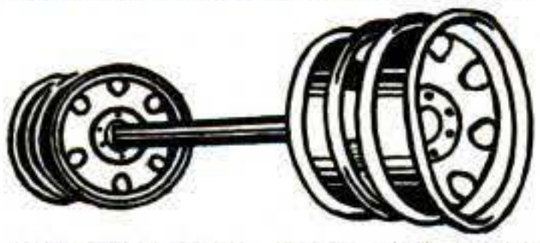

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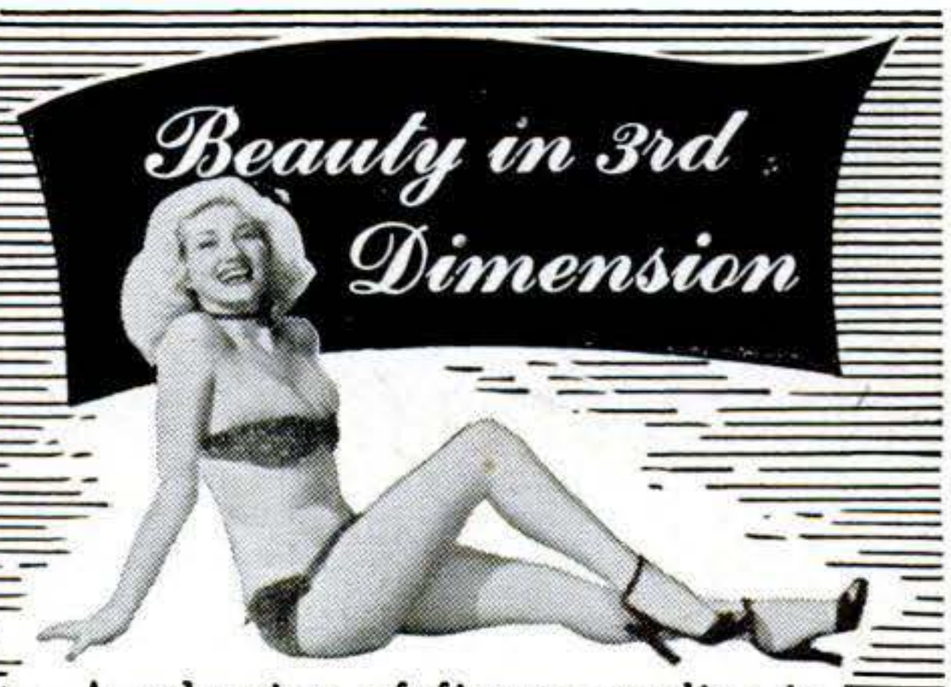

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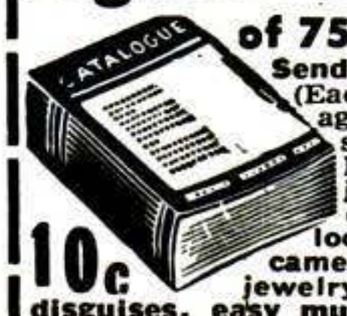

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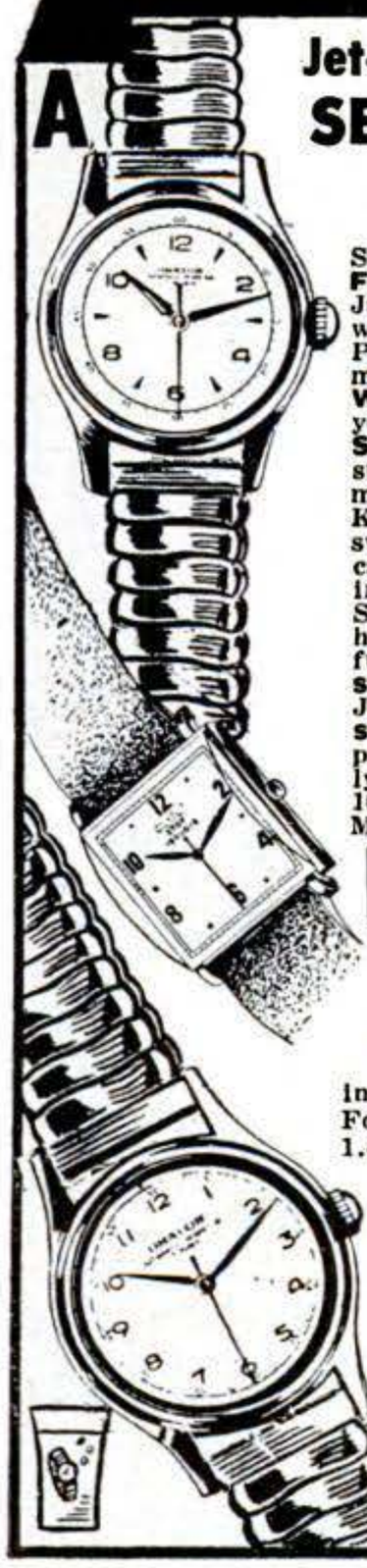

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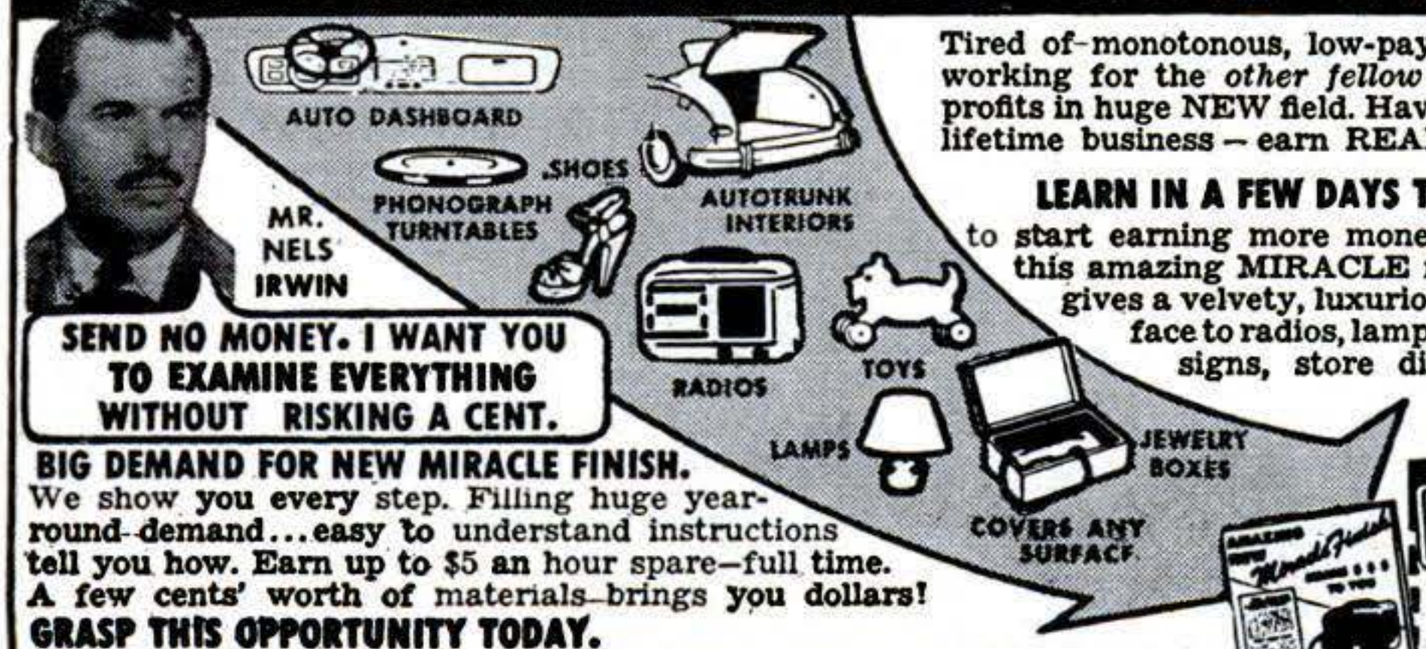

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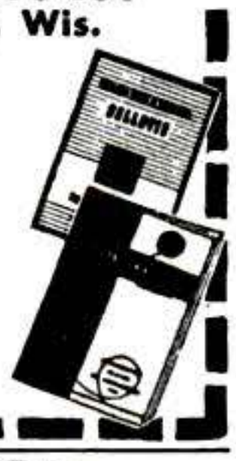

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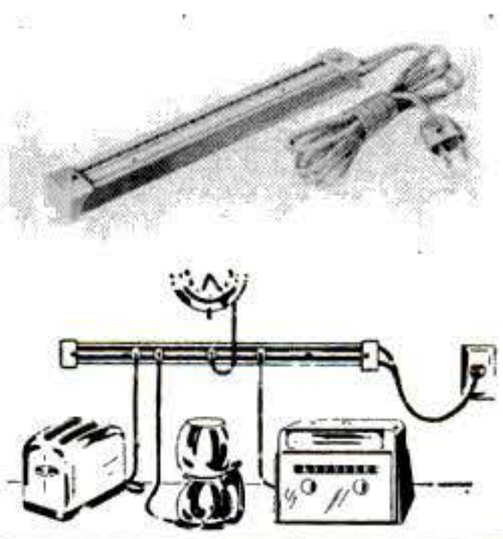

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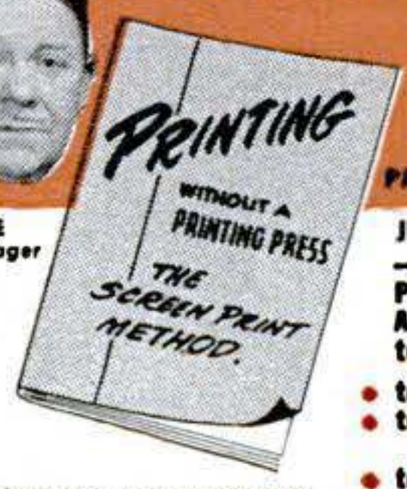

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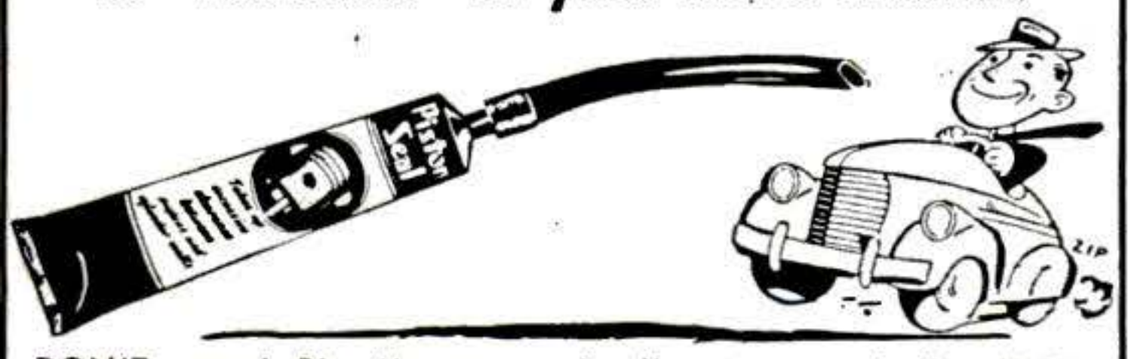

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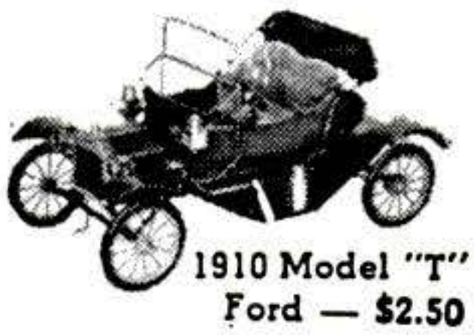

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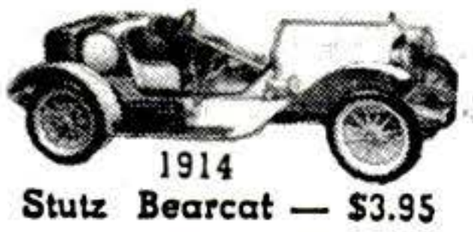

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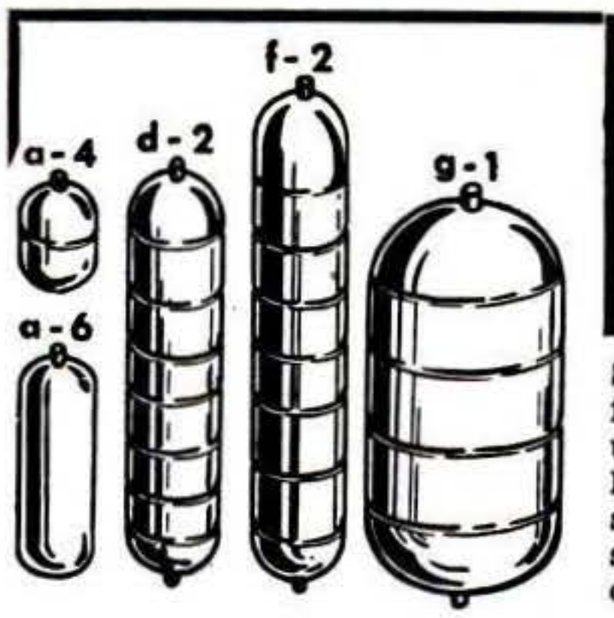

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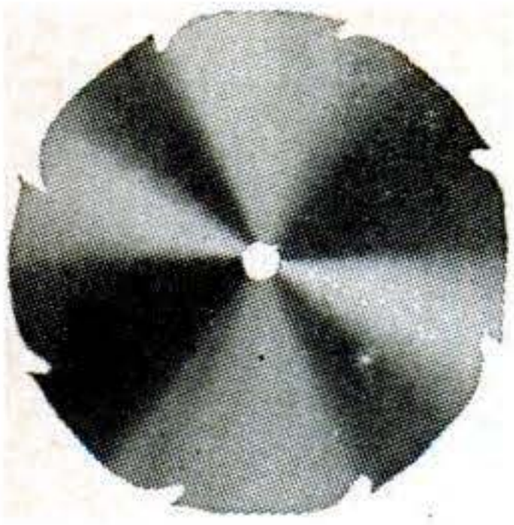

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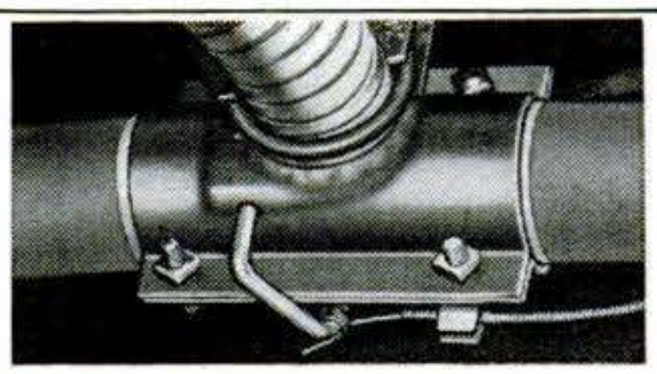

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550-17	5.94	760-15	6.54	32x6(10)	13.92	1100-22	18.54
525-18	5.[illegible]	820-15	7.04	750-20	12.54	1200-22	22.54
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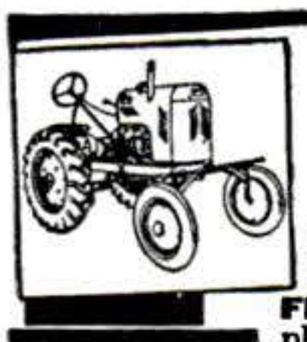

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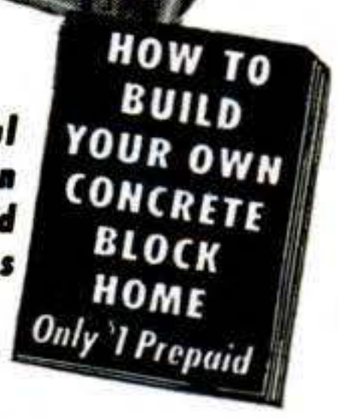

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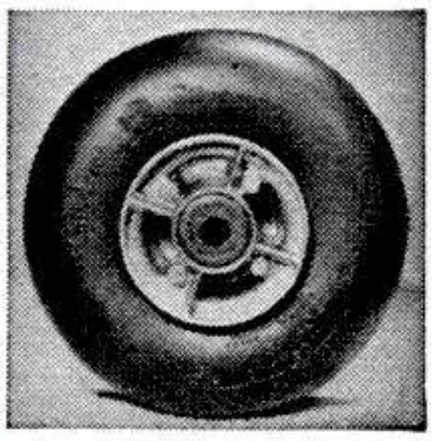

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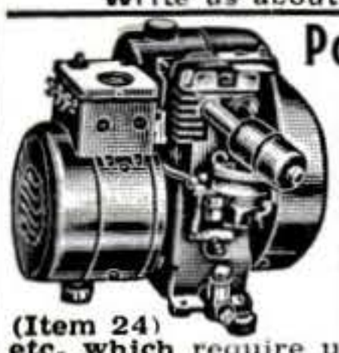

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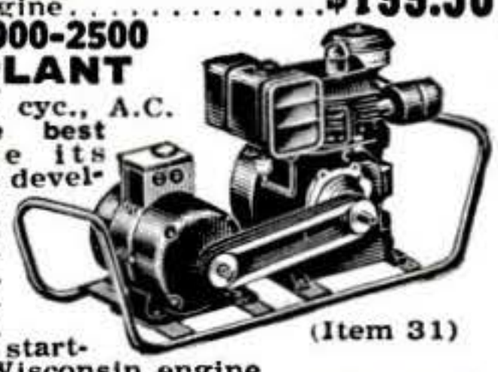

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(Item 60) Type SCR 578, portable. Only 18 lbs. Ideal for boats, Hams, etc. Crank operated generator produces ample current to send Morse code (built-in hand key), blinker light or continuous automatic SOS. 500 KC, mck. Can be converted to power transmitter. Contains hundreds of valuable parts. Built in antennae and ground. Slightly used for training. Complete instruct. and Morse code incl. Cost govt. over $200. Terrific value. **$18.95**

GIANT BUNSEN BURNER

(Item 61) Operates equally well on gas or ordinary alcohol. Economical. 1 pt. burns for hours. Produces intense blue smokeless flame. Ideal for lab. or as emergency cooking unit. Fine for camping. Heavy brass burner with shut-off and adj. valve. Simple and safe. 5 ft. flex. hose, 1 qt. tank incl. Wt. 5 lbs. A $15 value. Spec..... **$4.95**
(Item 62) Metal Cooking Stand for above (not illustrated)..... **$1.49**

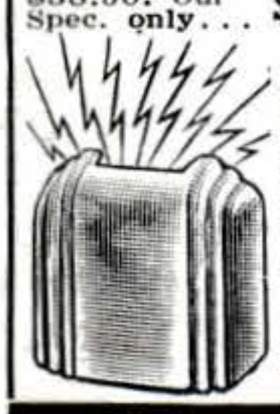
¼" DRILL

(Item 34) Hi-power, long-life, smooth running. Alloy steel gears; built-in blower. Cutler-Hammer switch. Jacobs hand-tite chuck. 110-120 v. AC-DC 1000-1600 rpm. Cap. ¼" in steel. 1 year guar. Wt. 4 lbs. Terrific value at **$12.95.**

38 Pc. DRILL KIT

(Item 35) Includes above illus. guar. drill, buffers, polishing bonnet, sanding discs, grinding wheels, wood bits, steel bits, wire wheels, bench stand, paint mixer, burrs, Complete in steel case. Wt. 13 lbs. 38 pc's., all highest quality. Complete kit worth $38.50. Our Spec. only... **$19.85**

FIRE or BURGLAR ALARM



(Item 46) Completely automatic. Wind and hang anywhere. Thermostatic element sets off loud clanging bell if heat reaches 140° (setting adjust.). A fool-proof burglar or signal alarm when used with trip cord attached to door, window, invalid's bed, etc. Sturdy metal constr. assures lifetime of protection. Ideal for homes, stores, whse., gar. etc. Wt. 3 lbs. Easily worth $20. Special.. **$4.95**

HEAVY DUTY ARC WELDER

(Item 38) Use as portable or shop welder. 250 amps. D.C., Senior model. Made for years of trouble-free, continuous service. Will handle light or heavy jobs. Weld up to ½" plate using ¼" rods. Built-in air-cooling system. Arc is easy to strike and hold, because of specially designed arc stabilizer. Hi-lo switch and dial control gives wide range of welding heats. Run welder at 2600 rpm. with tractor, jeep or 10 hp. gas engine, or 7 hp. elec. motor. Complete with instructions, guar. and double V belt or flat pulley. Wt. 110 lbs.
A $400 value at..... **$99.75**
WELDING KIT. Two 10 ft. leads, welding helmet, electrode holder, ground clamp. Sold only with welder at.... **$10.50**

DUAL TUBE LIFE SAVERS

(Item 54) NEW APPROVED TYPE made by Genl. Tire for Navy. Each has 2 rubber tubes for double protection. Easily inflated by mouth to 55 in. Wear one around waist as comfortable life saver. Adjustable safety buckles fit adults or children. Tie several together for raft or big luxurious mattress. Invaluable on boats or beach. Wt. 2 lbs. each. Our spec. (a fraction of cost) 99¢ each, 6 for.. **$5**

HIGH PRESSURE HAND PUMP

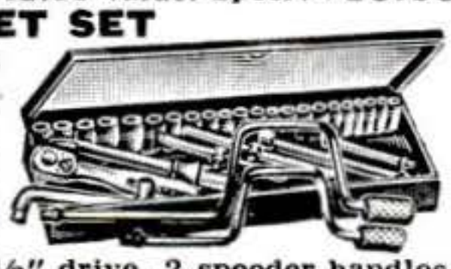
(Item 53) Positive displacement type. Cap. 550 gph. Completely self priming. ¾" pipe thread inlet and outlet. Use for fuel or water transfer on boats, trailers, air craft, etc. Ideal for insecticides, emerg. sump pump or as vacuum pump. Wt. 15 lbs. Govt. cost $95. Our Special..... **$12.95**

FIRE EXTINGUISHER

(Item 39) Fully charged (at 1,000 lbs. P. S. I. or more) with CO_2 (carbon dioxide), the proven miracle fire fighting chemical that smothers oil, gasoline and electrical fires. Play safe; keep one in your car, garage and home. Heavy ICC approved steel cylinder, valve and 3000 lb. gauge that shows available remaining pressure. REFILLABLE at nominal cost. Hose included for emergency tire inflator or air blast. Wt. 4 lbs. $19.50 value. Special..... **$6.95**

LARGE FIRE EXTINGUISHER (Item 57) commercial size, 5 x 14 in. (275 cu. in.) heavy ICC approved steel cylinder charged at 1000 lbs. or more with CO_2. Equipped with genuine Kidde Valve and Gauge to show available pressure at all times. Refillable. Hose incl. Suitable for fire depts., stores, garages, homes, etc. Wt. 18 lbs. $42.50 value. Spec.. **$15.85**

32 pc. SOCKET SET



(Item 59) Highest quality guar. non-breakable sockets made by Plomb, Snap On, etc. Complete range of 22 sockets from ¼" thru ¾" in ⅜" drive and 7/16" thru 1-1/16" in ½" drive. 2 speeder handles, 2 extensions, 2 slide heads, double ⅜ x ½ in. "L" handle, reversible ratchet, 12" Phillips type screw driver and metal tool box. For professional mechanics who want the best. Wt. 14 lbs. Easily worth $32.50, while they last..... **$15.95**

RUBBER HOSE

TERRIFIC VALUES!

New genuine Neoprene Hose — outlasts ordinary rubber 3 to 1. Reinforced with super tough cotton cord plies. Flexible. Easy Flo brass couplings with standard pipe threads for quick connections, included. Pump water for irrigation, stock tanks, home, barn, fire fighting, etc. Pump Gas or Fuel Oil. Save more than 60%.

(Inside Diam.)	1¼"	1¼"	1½"
Length	25 ft.	40 ft.	30 ft.
Price	9.25	14.75	14.75

If specified we will send special hose for gas or oil at same prices.

AIR HOSE (Item 11) ¼" Diam. heavy duty, double braid, suitable for gas stations, spray painting, air tools, etc. 20 ft. with standard swivel couplings. Wt. 4 lbs. Reg. $6.50 val.—only **$2.95.** Five 20 ft. lgths. (100 ft.). Wt. 20 lbs. Only **$13.75.**

EXTENSION CORD

(Item 16) 40 ft. heavy duty, made of specially insulated No. 14 2-conductor wire. So tough that you can drive over it and yet amazingly flexible and easy to handle. Resists oil, grease or water. Extends electricity up to 400 ft. without voltage drop. Use indoors or out. Complete with heavy rubber plug and outlet. Wt. 2½ lbs. Usually $4.50—Special 40 ft. **$1.99**
Comb: 2-40 ft. and 1-20 ft. (total 100 ft.) **$4.95**
100 foot length (one piece)..... **$4.85**
WIRE ONLY (Item 50) No fittings, 100 ft..... **$4.00**
TRENCH-LAY WIRE. (Item 51) Anaconda #10 —2 cond., for buried service to barns, outdoor lights, etc. Absolutely impervious to soil and moisture. Wt. 25 lbs. per 100 ft. Special surplus price. 100 ft. coils, 19¢ per ft.; 250 ft., 18¢ per ft.; 500 ft., 17¢ per ft.

HEATING & VENTILATING FAN

(Item 10) Easily installed in furnace pipes. Forces even heat to all rooms. Over range, removes kitchen smoke and odors. Powerful continuous duty motor, 110-120 V. A.C. Quiet, super efficient fan moves huge volume of air (400 to 600 c.f.m.) 8" Fan, wt. 5 lb. **$6.35**; 9" Fan, wt. 6 lbs. **$7.45**; 10" Fan, wt. 7 lb. **$8.45**; 12" Fan, wt. 8 lbs. **$9.45.**

G. M. HI-FLO PUMP

(Item 56) 210 gal. per min. Centrifugal turbine type. Unexcelled for fire-fighting, irrigation, sprinkling systems, swimming pools, drainage, fuel transfer, etc. Built by GM for the army at cost of more than $145. Tremendous volume, will deliver 210 gpm with 5.3 hp. down to 40 gpm with 1½ hp. 2½" stand. pipe thr. inlet (can be reduced to 2" if desired). Twin 1¼" outlets, dynamically balanced, ¾" shaft, hi-speed ball bearings. Easy fast priming. (instr. incl.) Wt. 36 lbs.
Sensational value..... **$39.50**

ELECTRIC HAND SAW

(Item 36) Most perfectly balanced and smoothest running saw made. Advanced design provides max. power and light weight. Easily adjusted for all angles, depth and width of cut. Comes complete with 6¼" comb. blade, ripping guide and 10 ft. hvy. duty cord. Built-in saw-dust blower. Autom. telescoping guard. 110-120 v. AC-DC. Depth of cut 2¼". 1 year written guar. Wt. 12 lbs.
Drastically reduced..... **$39.95**

SPRAY OUTFIT

(Item 37) Twin cyl. piston type compressor direct-connected to powerful 110-120 v. AC-DC motor. Built-in air tank eliminates pulsation and provides steady flow of air at 25-30 lbs. Sprays lacquers, enamels, insecticides, etc. Does beautiful work on autos, furniture, farm equip. 1 qt. spray gun, relief valve and 10 ft. air hose incl. Full instructions and 1 year guar. Wt. 11 lbs. Regularly $50. Spec..... **$22.95**

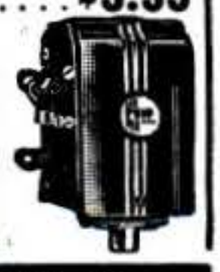
ANGLE DRILL

(Item 23) Fits into chuck of any electric or pneumatic drill or flex. shaft. Operates at any angle in a full 360° arc. Makes possible drilling, grinding, carving, routing, etc. in close cramped quarters. Makes impossible jobs easy. Made by Kett Tool Co. Complete with built-in chuck (¼" capacity) and adjusting key. Hardened alloy gears. Precision built for heavy duty. Lists at $39.95—while they last..... **$9.95**

CARRY-AIR

(Item 32) Stainless steel tank—capacity 500 cu. in. at 400 lbs. press. complete with inlet and shutoff valves, press. gauge, detachable air hose, tire chuck. Fill at any service station. Carry air for tire inflation, blowing out lines, spray painting, insecticides, etc. One emergency pays back cost. Wt. 10 lbs. Worth $20.00. Our price..... **$8.95**
(Item 55) With big double tank (1000 cu. in.)..... **$11.95**
(Item 58) Tank only, 500 cu. in. (no fittings)..... **$5.95**

PRESSURE SWITCH



(Item 30) Penn Electric Model 110 BPO2, best made. For pumps and air compressors. Heavy duty. Will handle up to 250 lbs. press. and up to 5 h. p. Autom. unloader valve, for easy starting. 110-220 v. A.C. or D.C. 2 pole. Wt. 5 lbs. Reg. list $17.50. Our Spec. $9.45.

All items *brand new*. Prices f.o.b. Chicago area. 10 day Money back guarantee. Send check or M. O.

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POPULAR SCIENCE MONTHLY-351 FOURTH AVE.-NEW YORK CITY 10

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"INJECTION Systems", latest methods, $2.00. Large Magnetic Dash Trays—$1.00. Auto Products, Box 9407, Richmond 28, Va.

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RUBBERIZED liquid coating prevents tarnish, keeps chrome bumpers trim gleaming bright. 300% profit. Rubber Products Inc., New Haven, Conn.

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KEY case and tire gauge combination—retails $1.00. Discounts to salesmen—dealers send $1.00 for sample. Box 2692, Lakewood 7, Ohio.

JOIN new National Auto Club—save on Auto Equipment—Send for Free Newspaper. AA Custom Club, 123 W. Washington, Los Angeles 15, Calif.

VAPOJET helps save gas, engine wear, carbon accumulation and increase power with water-alcohol vapor injection. $9.95 postpaid. $1 deposit C.O.D. 30 day money-back agreement. Easily installed. Free details. Agents wanted. Bantel, 757-AZ Venice, Los Angeles 15.

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MOTORIST save gasoline by Vacu-mating overrich mixtures. Fits all cars. For Free particulars write Vacumatic, Dept. 1770, Wauwatosa, Wisconsin.

FOR as little as $8.00 you can put your ad here in the October issue. Get in on the beginning of the Fall mail-order rush and deliver your sales talk direct to the 3,992,000 readers of Popular Science. Same low rate you've always paid—80c a word. The October issue closes on August 23rd!! Write today for order blank and free booklet, "How To Make Money Out Of Classified Advertising". O. K. Kelly, Classified Advertising Manager, Popular Science Monthly, Dept. A-2, 353 Fourth Avenue, New York 10, New York.

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BUILD your own trailer! Plans for all kinds. Illustrated catalog 10c. Jim Dandy, 125-S, Wausau, Wisconsin.

4 MOTORCYCLES, BICYCLES AND SUPPLIES

TWO passenger Motorette midget car $45; Servicycle $35, Doodlebug motorscooter $5, Cushman $15, Motorbike $5, less engines. Two cylinder motorwheel $10; Briggs engines $5 up. Four airplane type tires $3. Mailorder only. Send 25c for new catalogue Number 42, just out listing these and hundreds of other bargains in new and used midget cars, motorscooters, homebuilders parts, plans, engines, transmissions, clutches, war surplus, etc. (35c by First Class Mail). Midget Motors Directory, Athens, Ohio.

REBUILT Gasoline Engines $9.00 to $30.00. Cauffiel Motor Industries, Temperance, Michigan.

RECONDITIONED motorcycles and motors. Chromium accessories. Complete stock Indian parts. Expert rebuilding. Fast service. Indian Motorcycle Sales, Kansas City 1, Mo.

WHIZZER motorbike (all attachments) $25.00; others $5.00 up; Cushman motorscooter $20.00; Indian Motorcycle $30.00; Briggs motors $5.00 up. Rush 25c (35c first class mail) for catalog #949 listing many other amazing bargains in motors, Midget cars, motorscooters, motorbikes, etc. Associated, Box 1764-CS, Toledo, Ohio.

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JET Engine Plans $1.00. Make your own. Any Size. Simple 2 hr. job. JWS, 500-P N. Tamarind, Fontana, Calif.

PROPELLERS, plans, supplies for snow sleighs, air boats. Catalog 20c. Banks-Maxwell, Box 3301, Ft. Worth, Texas.

7 ELECTRICAL SUPPLIES & EQUIPMENT

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BUILD Power machines with Kimo Plans, New York 19. Descriptives 25c (refundable).

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HOTTEST surplus list in the country. Electronics, Hydraulics, Aircraft, Gadgets. Dick Rose, Everett, Washington.

POWER tools, equipment wholesale prices. Free Bulletin. Homecrafters Co-operative, Grand Rapids 6, Michigan.

REBUILT Gasoline Engines $9.00 to $30.00. Cauffiel Motor Industries, Temperance, Michigan.

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FULL size, cut to shape boat patterns, blueprints. 7½-38 feet. Illustrated "Build a Boat" catalog 25c (coin). "How to Build Boats" book. $1.00. Cleveland Boat Blueprint Co., Dept. A-77, Cleveland 13, Ohio.

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FORD and Jeep marine conversion catalogue 25c. Oscomotors, 3627F Lawrence, Phila. 40.

MARINE conversions for Ford and Jeep engines. Catalog 10c. Lehman Manufacturing Co., 972A Broad St., Newark 2, N. J.

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BARBELLS, Dumbbells. Exercise equipment. Courses. Free booklet. Good Barbell Co., Reading, Penna.

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SAVE 50% On New Binoculars! Free Catalog. Free book, "How to Select Binoculars." Write today! Bushnell's, 43-P28 Green, Pasadena 1, California.

GIANT, 100 power astronomical telescope with 6 ft. tripod (10,000 area magnification) Clear Vision full power guaranteed. $15.00 F. O. B. factory. Suffolk Science Services, Dept. TC, Riverhead, N. Y.

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BINOCULARS, telescopes, microscopes. Our 20th year of leadership in optical values. Bargain catalog free. Brownscope Co., 24 West 45th St., New York.

AMAZING prices, brand new precision binoculars, $16.00 up. Free trial. Folder "Binocular Selecting," pricelist free. Prentiss Importers, Mercury Bldg., West Los Angeles 25, Calif.

REFLECTING Telescopes, completely assembled, 60X, $25.00. Guaranteed Observatory clearness. Free information. Skyscope, 475 Fifth Avenue, New York 17.

POWERFUL astronomical telescopes easily made. Perfect lenses and instructions; 100x $3.00; 100x and 200x $4.00; 100x, 200x and 400x $6.00. Full power, clear vision guaranteed. Instructions alone 10c. Suffolk Science Service, Riverhead, N. Y.

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FREE 20-page Binocular Catalog. Over 60 different models. United, Dept. ARF-4516, 9043 S. Western, Chicago 20.

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CAST Iron Molds—for making your own sinkers. Write for free illustrated booklet. Reading Instrument Co., Box 78, Reading, Pennsylvania.

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AMMUNITION immediately available for Lugers, Mausers, Japanese, Italian guns. Send 10c; complete list; 100 kinds. Also 8 power Pocket Telescope, $5.00; Cameras, Microscopes, Rifles, Crossbows, Knives. Ashton Co., 1511 North Gardner St., Hollywood 48, Calif.

5,000 BARGAINS, firearms, binoculars, war relics, catalog 50c. Smith Museum, Runnemede, N. J.

MOLDS "For fishermen, sinker, squids, jigs, and lures" handled and hinged, quality fishing tackle, free catalogue. Sweets Molds, Tonawanda, New York, Box 163.

SEND 10c for lists either shotguns, rifles, handguns, ammunition or send 25c for all lists. Frayseth's, Willmar, Minnesota.

OVER 500 guns, modern, obsolete. List 10c coin. Ed Howe, 26 Main, Coopers Mills, Maine.

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16 TESTED, easy to make one tube circuits 25c, including "Radiomaker." catalog. Berk Labs, Dept. PSM2, Alum Bank, Pa.

NOW you can build the Radio-Phonograph or TV Set of your dreams—and it's so easy! Step-by-step, easy-to-follow picturized instructions show you everything you need to know in exciting new volume —"How To Build 78 Radio And TV Sets." Over 100,000 Radio and TV amateur enthusiasts have already claimed their fun-packed copies. Big book is jammed with over 250 pages of simple, non-technical instructions and six-color illustrations showing easy ways to make your own TV set from an Assembly Kit, a 10-Meter Band Radio, a 1-Tube Short-Wave Converter, Master Music System for your Home, 4-way Portable Radio, Child's 2-Tube Headphone Set, Wireless Record Player to Broadcast through your Radio, and Much More. You'll save dollars and have grand fun modernizing, repairing and adding luxury features to your set! Supply limited. Rush only $1.98 for valuable book. Popular Science Monthly, Dept. 851-C, 353—4th Ave., New York 10, N. Y.

37 BUSINESS OPPORTUNITIES

TO $35.00 Weekly. Spare Time. Home Operated Mail Order Business. Successful small "beginner's" plan. Everything Supplied. Lynn, 5710-C Bankfield, Culver City, California.

GOOD Paying Business Silvering mirrors, plating autoparts, reflectors, bicycles, bathroom fixtures, etc., by late methods. No tanks or shop required, outfit furnished. Free Booklet. Gunmetal Co., Ave. E. Decatur, Illinois.

ENVELOPES addressed accurately, reasonably. Fast Service. We have capable addressers in your city. Glenway System, 5713-X Euclid, Cleveland 3, Ohio.

BE Appointed State Notary Public now! Details. Stationers, Helotes 50, Texas.

OPERATE profitable mail order business. Write Walter Service, 4159-B East 112th, Cleveland 5, Ohio.

MAKE money addressing envelopes. Our instructions reveal how. Glen Glenway, 5713 Euclid, Cleveland 3, Ohio.

BIG money! Spare or full time in your home. No Selling! Spray New Miracle Finishes, Plush and Suede, on signs, radios, automobiles, figurines, lamps, toys, etc. Our business is booming. Help us fill huge demand. New easy Flok-Kraft methods. Material costs few pennies. You get dollars. Free samples, complete powerful money making plan free. Write now. Coast, 1002-L, Los Angeles St., Los Angeles 15.

FABULOUS Earnings—Fascinating pastime. Growing Genuine, living miniature (Ming) Trees. New sensational Business or Hobby. Astounding information Free. Dwarf Gardens, Box 355H, Briggs Station, Los Angeles 48, Calif.

RECAST old batteries into new. Latest achievements. Battery Laboratories, Minneapolis.

MAKE Money At Home as renewal headquarters for all magazines. Liberal commissions. No experience, no capital needed. Supplies furnished. Write for Free Catalog. McGregor Magazine Agency, Dept. 510B, Mount Morris, Ill.

INCOME from local information. No selling. Write—Neherco, La Verne 6, Calif.

START Mailorder Bookshop—Everything furnished. 25c brings booklet, samples, exciting ideas. General Publications, Ossining 1, New York.

START a Venetian Blind Laundry. Profit opportunity for lifetime business. New machine method. Free booklet on request. F. D. Co., 442 N. Seneca St., Wichita 12, Kansas.

MAKE Money spare or full time casting Metal Toys and Novelties. Big wholesale and chain store demand for Autos, Soldiers, Ashtrays, Banks, etc. Keeps manufacturers busy. Production moulds furnished for up to 100 and more castings per hour. No experience or special place necessary. "Cash-in" on holiday orders now being placed. Write for information and illustrations of patterns needed. Metal Cast Products Co., Dept. E, 1696 Boston Road, New York 60, N. Y.

MAKE Perfumes. Write "Carey Laboratories," 1914 Chouteau PS-B8, St. Louis 3, Mo.

EARN Money At Home With Your Typewriter! Spare time! Details free. Edwards, Publisher, 3915-PS, 12th, Des Moines 13, Ia.

SEWING Machine Spare and Full Time Repairmen Wanted. We train you. Income unlimited. Motors, new machines, supplies furnished. Write, Taylor Service Co., Hamilton, PS-8, Ohio.

SELL by Mail, free details, instructive booklet 25c. Manhattan House, Box 51-L, St. Albans 12, New York.

NEED extra money? We offer 137 successful plans to start a home business in spare time. Small capital, no experience required. Stanko, 6215 Woodhaven, Rego Park, N.Y.

"YOUR Phone Is Your Fortune". Send for free descriptive circular. Richard Sales, Box 675, Richmond, Va.

HAVE a new whirlwind mailorder proposition, exceptional profits Baucom's, 1411 So. First, San Jose, Calif.

WANTED! Home Producers by manufacturers in our Clearing House Service. Become a sub-contractor, casting plastic products for these companies Thousands of easy to make items required. Cash in at home without previous experience. For details write Plastic Service Guild, Dept. P.S., 233 Condor St., East Boston 28, Mass.

INCREDIBLE profits of War Surplus can be yours. Read the new 1951 copyrighted War Surplus Report. Tells how to buy direct from Government. Covers every faze of Surplus dealings. Only $2.00. S. & S. Publications, Box 1218-D, Goldthwaite, Texas.

HOW and where to obtain Capital? Free details. Star Service, Wapakoneta, Ohio.

LIQUID Rubber, make flexible molds. Free Sample. Chaney, 1130 E. 16th St., Jacksonville 6, Fla.

TRADE Magazines help you to success. Get latest copies through our easy-to-get-acquainted service. Nearly 1,200 business, professional, agricultural, automotive, educational, sport, hobby, music, writer, television, etc. List Free. Commercial Engraving Publishing Co., 34S North Ritter, Indianapolis 19, Indiana.

$10 HOUR! Invisible Reweaving Course. Including steel tool, 17 pictorial samples, material for life, $3. Complete Details free. Walsh, 894 Main, Buffalo 2, N. Y.

MAIL Order Business from your home. Free information. Sprusil, Box 34S, Corona, New York.

TREMENDOUS profits, new guaranteed Cedar-Wall! Mothproofs closets, drawers, trunks forever! Laboratory approved, applied like paint. Building supply dealers, stores, contractors, housing developers buy quantities. Attractively packaged, strong sales material. Exclusive Distributors, write, wire now for samples, etc. Millen Mfg., 96B Summit Ave., Brookline, Mass.

A Small Business—In Spare Time. British agencies offer pleasant, profitable spare time occupation. Unique postal course instructs, assists. Explanatory booklet free. Anthony Wade, 8/119, Hamilton Terrace, London, N.W. 8, England.

HOME Business of your own! Full time or spare time earnings up to $500.00 monthly. Information free. Western G. Aircraft, Los Angeles 19.

YOUR own profitable home business. Preserve live flowers to last forever. Spare or full time. New discovery—simple—fascinating. No experience necessary. Send $2.00 for working equipment, instructions and valuable sales plans. Satisfaction guaranteed or money refunded. Hermansen, 210 Fifth Ave., Suite 1102, New York 10, N. Y

MAKE Rubber Stamps, repair dolls, learn invisible reweaving, repair sewing machines. Catalogue of "40 Ideas." Universal, Box 1076-B, Peoria, Ill.

MAKE paint rollers for painting 7" tubes metal ends per hundred. $8.00. Sample postpaid 25c. X-L-O Products, Oconomowoc, Wisconsin.

MAKE flexible molds! Cast plaques, bookends, figurines! Free sample! H. Tooker, 630-A Chestnut, Hamilton, Ohio.

FREE mail selling book "$100 Day Profit." 35th year. Carl A. Torrey, Melrose 76, Mass.

NATURAL Molding Latex. Extra thick. Free sample. W. Wooley, 115B Donald, Peoria, Illinois.

DOLLARS for dealers names, details—Dime (refundable). Home Store, 3116 Seminary, Chicago.

QUICK Sign Painting. Use Letter Patterns. Avoid sloppy work, wasted time. Write for folder. John Rahn, B1330 Central Ave., Chicago 51.

LEARN Invisible Reweaving! $10.00. Frank Harris, P. O. Box 7112, New Orleans, Louisiana.

COULD you use $50.00 per week? One-half days work. No seling, soliciting. Write:—Harry Walter, Mediapolis, Iowa.

$250 WEEK reported. Free book "505 Odd, Successful Businesses." Work home. Expect "Odd"!! Pacific-8, Oceanside, Cal.

FREE Illustrated course casting novelties. Genuine latex for molds. Major Latex & Chemical Co., 25 Allerton St., Boston 19, Mass.

TRAVEL Anywhere, Anytime. Earn $50 up a week. Free details. Travel, La Grange 22, Indiana.

ORGANIZERS wanted for the national debating club. Good pay; patriotic service. Thursday Evening Club, 324 Newbury Street, Boston, Mass.

FIGURINES unpainted, free illustrated list. Haverty Products, 822-A 17th Street, Altoona, Penna.

DOLL Repair Book, $1.25 prepaid. Grand Rapids Doll Hospital, 3824 Division, Grand Rapids 8, Mich.

CHINCHILLAS for sale. Young pairs, breed pairs or proven breeders. Excellent breeding stock. Registered with N.C.B.A. cash or terms. Write, Dresch Chinchilla Farm, Wig-Hill, Chester, Conn.

HUNDREDS of unusual moneymaking plans 25c to $10.00. All or spare time. Catalog 25c (refundable) Charles Company, 12-BPX, Norwood, Ohio.

EXTRA Dollars. Spinning angora wool for us. Angora House, PSM, Springfield, Ill.

EASY Money, Spare time. Adena's Service, 45 North First, San Jose, Calif.

FREE Book "372 Unusual Worldwide businesses." Work home (U.S.A.)! Publishers-14, Carlsbad, Calif.

MAKE $10,000 yearly raising angora rabbit wool for us. Particulars 25c. coin. American Angora Company, Malta 20, Mont.

MAKE Perfume—Catalogue Free. "International", 6347 Parnell-PS-8, Chicago 21, Illinois.

FREE—gift—women who sew. Hurry. Siegal, Box 183, New York 2.

INEXPENSIVE, profitable home process for electroplating metals, mirrors, nonmetals. Free booklet. Tyco Metals, Box 13231-AJ, Houston 19, Texas.

MAKE Money Addressing Envelopes! Write Malco Company, 215-PS Wilson Ave., Columbus 5, Ohio.

$46 FROM Square Foot Plywood; Jigsaw necessary. Write: Woodart, Bridgewater, Massachusetts.

BUY it wholesale. Manufacturers, Distributors. Over 850,000 items. Literature free. Olsen, 1231-B East Third St., Duluth 5, Minnesota.

HOW To Set Up and Run A Mirror Shop! Resilvering Mirrors. Making Chipped Glass Nameplates. Electroplating Salts and Rectifiers. John Sprinkle V90, Marion, Ind.

SPARE-Time office work in your own home for Men and Women. Free details. Business Publishing House, 127M Broad St., Boston 10, Mass.

BOOKKEEPERS earn $100 weekly operating Simplified Bookkeeping-Tax Service. Details free. Universal, Box 664-P, Springfield, Missouri.

COLORGLAZED Concrete Pottery made without molds. Patented method Cemetery products, novelties, tiles, Basement leak-sealing. Money-making projects. Booklet, details free. Men only. National Potteries, Grand Rapids, "Minnesota."

GROW Mushrooms, Cellar, shed, Spare, full time. We pay $3.00 pound. Free Book. Mushrooms, 2954 Admiral Way, Seattle, Washington.

SECURITY. $10,000.00 yearly possible. Investigate. Boyd, Fitzsimons Building, Pittsburgh 22, Penna.

FOR as little as $8.00 you can put your ad here in the October issue. Get in on the beginning of the Fall mail-order rush and deliver your sales talk direct to the 3,992,000 readers of Popular Science. Same low rate you've always paid—80c a word. The October issue closes on August 23rd!! Write today for order blank and free booklet, "How To Make Money Out Of Classified Advertising". O. K. Kelly, Classified Advertising Manager, Popular Science Monthly, Dept. A-6, 353 Fourth Avenue, New York 10, New York.

SELL & Install: Burners, Furnaces, Cooling coils, Blowers, Peerless, Lincoln 6, Nebraska.

Copyrighted material

MAILING postcards selling repeat merchandise is profitable. Everything supplied. Details free. Gordon Publishers, Box 23, Pawtucket, R. I.

MEN-Women—"Everybody likes Candy." Learn to make professionally at home. (Our 40th year.) Ragsdale Candies, East Orange, New Jersey.

FORTUNES made from Sandwiches. New system. Equipment furnished. Dickerson Manufacturing, Drawer 30-A, Springfield, Missouri.

GOOD news. 10c wil bring Big Mail with many $$$$ getting plans. Garick, 197 East 15th Street, Pittsburg, Calif.

PART time business, full time profit selling the most profitable auto accessory item. 18 million to be sold this year. Send $2.00 for sample kit to be refunded on first order. Allied Products Company, Dept. B.O., P. O. Box 1641, Columbus, Georgia.

IMPORT—Export! Men—Women learn from established World Trader. Your own profitable world wide business by mail order from home without capital; or travel abroad. Experience unnecessary. Free details. Mellinger, A-6 Los Angeles 24.

38 MONEYMAKING OPPORTUNITIES

QUICK profits taking magazine subscriptions, handling greeting cards. Cassell Publishers Service, Westfield, N. J.

RAISE your business value, standing, as State Notary Public. Information. Stationers. Helotes 50, Texas.

EARN Money Evenings, copying and duplicating comic cartoons for advertisers Adservice, Argyle 2, Wisconsin.

LEARN Auctioneering at home working with successful auctioneer. Revolutionary method provides classroom training in spare time. $100.00 daily often earned by trained auctioneers. Advance Auction School, 5944 North Newark, Dept. 104, Chicago 31.

DETECTIVES Earn Big Money. Experience unnecessary. Detective Particulars free. Wagoner, P-125 West 86th, N. Y. 24.

BIG opportunity mail containing many money-making offers only 10c. L. Rogers, 5322 Tremont, Dallas, Texas.

NEW Catalog and many Plans of money making ideas 25c. Swaty, Box 141-S, Kerrville, Texas.

MANUFACTURE Rhinestone and Pearl Jewelry at home. Latest creations, tremendous profits, no skill needed. Postcard brings illustrated catalog of settings, stones, etc. A. V. Cutt Co. Inc., 210-H Fifth Ave., New York 10, New York.

NUMEROUS money-making offers free. Keena, 1312 Jefferson, Grand Rapids, Mich.

WHERE to swap-buy-sell anything. Free information. Toole, 5 Bernardin Apts., Evansville, Indiana.

$250 WEEK reported; Home! Free book "505 Odd, Successful Businesses." Expect 'Odd"!! Pacific-7, Oceanside, Calif.

$100—$200 WEEKLY. No selling or manufacturing. Charge $80 up. Each job takes 8 hours. Theodore Mahaffay, 3032 Weldon, Los Angeles 65.

START profitable home business now. Write. Vee's, Box 301-PS, Decatur, Ga.

WE pay you highest rates for hand-decorating greeting cards. Work at home. Experience unnecessary. Greetings, 120 Madison, Detroit 26.

$$$ IN Personalized Baby Record Books. Sell By Mail Use Same Literature We Do. No-Co-Ro, Oakland 6-P, Calif.

FREE "Success Plan" (Worth $2)! Your own Mailorder Business! $10.800 profits! No risk! Treasury, 149 Storer, New Rochelle 49, New York.

100.000 MONEY-making ideas. World's greatest collection. Catalog 25c. Cummings, 1321 Arch St., Philadelphia 7P, Penna.

FOR as little as $8.00 you can put your ad here in the October issue. Get in on the beginning of the Fall mail-order rush and deliver your sales talk direct to the 3,992,000 readers of Popular Science. Same low rate you've always paid—80c a word. The October issue closes on August 23rd!! Write today for order blank and free booklet. "How To Make Money Out Of Classified Advertising". O. K. Kelly, Classified Advertising Manager, Popular Science Monthly, Dept. A-7, 353 Fourth Avenue, New York 10, New York.

MORE money, more happiness. Free booklet. Gold Star Company, 5864 Hollywood Blvd., Hollywood 28, Calif.

39 FORMULAS, PLANS, ETC.

FORMULAS, trade secrets, for nearly everything. Catalog free. Creative Publishers, Winnetka 7, Illinois.

FORMULAS—All kinds. Latest products. Literature free. Kemico, Park Ridge 15, Ill.

MANUFACTURE Facial Cream, hand lotion. Formula 25c. Oshkosh Homecrafters, Oshkosh, Wisc.

SAKE (saki). Exotic Oriental beverage. Authentic recipe. $1.00. Muru, Box 116, Stoughton, Mass.

LABORATORY tested formulas. Lists free. Pont, Box 635-PS, Terre Haute, Ind.

WINE made from any fruit. Booklet complete, easy directions. $1.00. $1.20 COD. Box 114, Long Island City 4, New York.

40 PLASTICS

NEW liquid plastic. Clear, colors. Cast without heat. Embed flowers, insects, coins. Saw, drill, carve. Free Folder. "Liquid Magic," shows fine things you can make and sell. Write today. Castolite, Dept. J-102, Woodstock, Illinois.

LUCITE, Plexiglas. Any size sheets masked Square foot (12 x 12) cost 1/16" $1.20; 1/8", $1.40; 3/16", $1.75; 1/4", $2.08. Include 10% postage. Almac Plastics, 230 Fifth Avenue, New York 1, New York.

PLASTIC Sheets, Rods, Tubes, etc. Free List. Plastic Supply Co., 2901 N. Grand Blvd., St. Louis 7, Mo.

LUCITE, Plexiglas, acetate; casting, molding plastics, findings. Dye manufacturer. Quantity prices. Special bargain lots. Immediate shipment. Complete catalog 10c. 25c airmailed. Gem-O'-Lite, Box 6864, North Hollywood, Calif.

PLEXIGLAS Sheets, 12x12" 1/16" $1.05—1/8" $1.30—3/16" $1.60—1/4" $1.90. Clear—Colored plus 10% postage. Everything in Plastic's. Catalog 10c. P. O. Box 1812, Salt Lake City 10, Utah.

41 CHEMICALS & APPARATUS

NEW Idea Chemical and Apparatus Outfits for Home Experimenting. Photo-Scales, Microscopes, Chemicals, Biological and Laboratory Supplies in Small Quantities. Catalog 25c. Established 1931. John H. Winn, 124-B West 23rd Street, New York 11, N. Y.

LUMINOUS Paints will glow in dark. Six colors. Fairmount Chemical Co., 136 Liberty St., New York City 6.

"AMATEUR Chemist" chemicals at reasonable prices. Amateur Chemist Supply, 191-49 115th Ave., St. Albans 12, New York. Catalog 10c.

CHEMICALS and apparatus for industrial, analytical, and private laboratories. Catalog 15c. Dept. M-26, Biological Supply Co., 1176 Mt. Hope Ave., Rochester 20, N. Y.

ILLUSTRATED Catalog: Chemistry, mineralogy, biology. 10c. Tracey Laboratories, Evanston, Illinois.

42 HELP WANTED

FOREIGN & Latin American Employment. 1951 "Foreign Service Directory" gives Up-To-Minute Facts on Military & Civilian Construction, Government Jobs, Major Oil Listings, Aviation, Transportation, Steamship Lines, Mining, Importers, Exporters, How-When-Where to apply, application forms, Hot List Firms Hiring. $1.00 post-paid. Global Reports, P.O. Box 883-S, Hollywood 28, Calif.

FOREIGN Employment Construction men, building trades, helpers, office men, others, interested in Foreign Projects. High wages, quarters, trans. Listings of firms actively working on U. S., Foreign, Intercontinental Projects. Send $1 for Foreign Construction Compendium and Application Forms. Foreign Service Bureau, Dept. PS-8, Box 295, Metuchen, New Jersey. (Not an employment agency—no fees.)

$1.000.000. CONSTRUCTION Projects Starting "World Wide." Send $1.00 for Complete Authentic Monthly Report on construction starting in India, Arabia, Europe, Alaska, Guam, South America, Puerto Rico, Bermuda, Hawaii, United States, etc. with application forms telling you How-When-Where to apply. Line up your next job now. Global Reports, P. O. Box 883-PX, Hollywood 28, Calif.

EARN money in any crowd. Call names of strangers, tell unspoken questions. Professional course mind reading, spirit writing, etc. $1.00. University Publications, 615 Davis, Evanston, Ill.

THIS Is For You! Adventure, excitement, big pay. A job overseas! Send $1.00 for foreign job news, information, application forms, etc. DCS Foreign Job News, Dept. 268-GA, Bridgeport, Ill.

$260 MONTH for beginners! Room, Board free. Travel, Adventure, Sailing Great Lakes. Complete Information $1.00. Skipper, Box 92, Avon, Ohio.

FOR as little as $8.00 you can put your ad here in the October issue. Get in on the beginning of the Fall mail-order rush and deliver your sales talk direct to the 3,992,000 readers of Popular Science. Same low rate you've always paid—80c a word. The October issue closes on August 23rd!! Write today for order blank and free booklet. "How To Make Money Out Of Classified Advertising". O. K. Kelly, Classified Advertising Manager, Popular Science Monthly, Dept. A-8, 353 Fourth Avenue, New York 10, New York.

43 AGENTS WANTED

NEW Jobs open in selling! Send name, address for five free issues of Opportunity Magazine's money-making guide, listing hundreds of companies who'll pay you well, full or part-time. No experience needed. Opportunity, 28 E. Jackson, Dept. 18, Chicago 4, Illinois.

DRESSES 18c; Coats $2.00; Blouses 35c; Free Catalogue; Crown, 164-PB, Monroe Street, New York 2.

COMMERCIAL Deep Frying Course, Mock Chicken Legs, Potatoes. New and proven methods. Learn about this money-making field. $2.50. PP. Concession, Toledo 13, Ohio.

AGENTS—300% profit selling genuine gold window letters; stores and offices. Free samples. Metallic Letter Co., 437 N. Clark Chicago.

PHOTO-Salesmen-Agents. Sell beautiful hand colored plastic enlargements and sensational new photo compacts, rings, bracelets, lockets, etc. Collect deposit, we deliver. Profitable sideline. Send card, for Free sample kit. Novel Portrait Co., 3343-A North Ave., Chicago, Ill.

NEED Extra Cash? Take orders for personal initialed belts and buckles, cap badges, tie holders, etc. Choice of 3000 emblems. Free sales kit. Hook-Fast, Dept. 1425PS, Providence, R. I.

BE A Money Maker . . . Use your home as magazine headquarters. Liberal commissions. No experience—No capital needed. Everything furnished. Write for Free Catalog. McGregor Magazine Agency, Dept. 510A, Mount Morris, Ill.

NYLON Uniforms. Immediate delivery, immediate profits. Free sales kit. Superior Fabrics, Dept. A-8, 3936 Market, Philadelphia 4, Pennsylvania.

CALL On Friends with sensational Christmas Cards in handy assortments. Exclusive designs. Sell for $1.00. Profit up to 50c. Also popular-priced Personal Christmas Cards, Everyday Assortments, Stationery, Gift Items. Samples on approval. Wallace Brown, Dept. B-4, N. Y. 10, N. Y.

JUST Out! New thrilling sensation in Christmas cards. Make big money! Show lustre foils, satins, brilliants. Amazing values bring easy orders! Christmas cards with name 50 for $1.25 up. Also imprinted book matches, stationery, many gifts. Get 30 Free Samples with name; several $1 boxes on approval. Joy Greetings, 507 N. Cardinal, Dept. K-61, St. Louis 3, Mo.

SALESMEN. Money-making sideline. Calendars and Advertising Specialties. Highest commissions advanced. Free New Cars. Rush name. Advertising Specialty Manufacturing Co., Brooklyn 36, N. Y.

START Your Own Business on credit. Always your own boss. 1,437 Dealers sold $5.000 to $28,500 in 1950; their average $6.704. We supply stocks, equipment on credit. 200 home necessities. Selling experience unnecessary to start. Wonderful opportunity to own pleasant, profitable business backed by world-wide industry. Write Rawleigh's, Dept. H-U-PSC, Freeport, Ill.

ANYONE can sell Hoover DuPont Nylon Uniforms for beauty shops, waitresses, doctors, nurses, others. In white and colors. Exclusive styles. Top quality. Low priced. Exceptional income. Real future. Equipment free. Write fully. Hoover, Dept. P-101, New York 11, N. Y.

YOUR Personal Lingerie free as bonus—extra cash besides—introducing sensational Curve-Tailored idea to friends. Outfit Free. World's Star, Dept. D-43, Grand Rapids, Michigan.

$50.00 YOURS, sell only 100 boxes New Xmas Cards; other amazing offers. Free Samples imprinted cards. Feature box assortments on approval; over 100 profitable items. Work with a National Leader. Pen-'N-Brush, PS-8, 139 Duane St., N.Y.C. 13.

GOLD lacquered Window Sign Letters. Large Sizes Penny Each. New foils. Absolutely Beautiful. Free Samples. Atlas, 544 W. 79th, Chicago 20.

Copyrighted material

AT Last! Something new and sensational in Christmas cards. Make extra money fast! Show gorgeous satins, velours, metallics never before offered. Gets easy orders! Pays up to 100% cash profit. Free Samples 30 Christmas cards with name, 50 for $1.25 up. 80 assortments. Personalized book matches and stationery, gifts. Several $1.00 boxes on approval. Write Puro Co., 2801 Locust, Dept. 141-K, St. Louis, Mo.

EXTRA cash—quick, easy! Sell friends newest greeting cards. Profits to 50c per $1.00 box. 21-card $1.00. Comic Christmas, All-Occasion assortments. Gift Wrap Ensembles, exclusive items. Experience unnecessary. Special offers. Bonus. Prompt service. Write for free samples Name Imprinted Christmas Cards, Stationery, Napkins, Book Matches. Feature assortments on approval, free catalog. Elmira Greeting Card Co., C-2210 Elmira, New York.

IS $210. a week worth a penny postcard to you? Then rush card with name and address for special Free Trial Plan that sells amazing new Automatic Refrigerator Defroster "like hot cakes!" Write to Mr. Lewis, D-Frost-O-Matic Corp., Dept. PSC-8, 6 N. Michigan, Chicago 2, Ill.

DO you need money? $35.00 is yours for selling only 50 boxes of our 300 Christmas Card line. This can be done in a single day. Free samples. Other leading boxes on approval. Many surprise items. Experience unnecessary. Free samples Personalized Christmas Cards, Stationery, Napkins. Write today. It costs nothing to try. Cheerful Card Co., 294 White Plains, N. Y.

HUNDRED blades 50c. Thousand English needles $1.40. Free cutrate wholesale catalogue. Mills Sales Co., 901 Broadway, New York.

MAN to earn $90 week up Long needed invention. Advertised Saturday Evening Post, Colliers. Prospects everywhere. Full or part time. Exclusive. No investment. Free Samples. Write Red Comet, Inc., Dept. 992, Littleton, Colorado.

MAKE extra money quickly! Take easy orders from friends for outstanding Christmas, All-Occasion greeting cards, Gift Wrappings, Novelties. Big profits. Bonus. Experience unnecessary. Request Feature assortments on approval, free samples Name Imprinted Christmas Cards, Stationery, Napkins and free Catalog. New England Art Publishers, North Abington 504-C, Mass.

GUARANTEED, Good, Housekeeping. Silverplate, Flatwear, Moneymaker. Murphy's Yale, Meriden, Conn.

FREE Samples, and amazing plan, giving you gorgeous Dress without penny cost. Rush name today, with dress size. Harford, Dept. E-235, Cincinnati 25, Ohio.

ABSOLUTELY Free! Big package actual sample fabrics and style presentation of dresses, lingerie, hosiery, etc. Take orders. Commissions big. Send no money. Melville Co., Dept. 6193, Cincinnati 25, Ohio.

BIG Daily Profits—selling embroidered wool and cotton uniforms, initialed buckles, belts, badges, choice 3,000 emblems. Free sales kit. Hook-Fast, Box 480PS, Roanoke, Va.

ULTRA-Blue Stock Signs—6c. Sell 35c. 1,000 slogans, 7"x11", comedy, religious, general. 15 samples, $1.00. Lowy, 812-SG Broadway, New York 3.

MAKE Wedding Profits. Sell invitations, napkins, matches. Samples free. Dunbar's, Middlebush 5, N. J.

NEW Bathroom Deodorizer. Hangs on wall. Banishes odors bathroom, kitchen. Lightning seller. Samples sent on trial. Kristee 131, Akron, Ohio.

CALENDARS, Advertising Novelties, Matches. All styles, including Religious, Varnished, 12 Sheet, Girls, Hundreds of Advertising Novelties, Book Matches, etc. Fleming Calendar Co., 6539 Cottage Grove, Chicago 37, Illinois.

CASH in on spare time. Sell wonderful Regal Christmas cards exclusive with us. 25 sell for $1.00. Also 50 for $1.25. Over 150 other boxes. Free samples. Kit on approval. Regal Greetings, Dept. 93, Ferndale, Michigan.

JEWELRY For Salesmen Distributors Direct Factory. Catalog Free. Pickcraft (c 19) Bank St., Attleboro, Mass.

$80 WEEKLY making four sales daily! Sell cushioned, non-cushioned shoes. Work shoes guaranteed six months. Free outfit. Concordian Shoes, 16-B West Concord, Mass.

LARGE Profits! Make Quality Perfumes at Home! No Alcohol! Rabiro, 246 5th Ave., New York 1, N. Y.

FACTORY Clearance—dealer's net cost. Power mowers—$46.00 (delivered). Rotacut-PS, Excelsior Springs, Mo.

FREE sample nylon stocking of world's only nationally advertised hosiery line actually guaranteed against runs and snags or replaced free within guarantee period to three months! Complete line from sheerest 15 denier to heavy 70 denier service weight. All gauges. Also complete line men's fine hosiery guaranteed for one full year! Not sold in stores. Good Housekeeping Guarantee Seal. No money or experience needed. Nothing to pay now or later. Easiest and quickest sales. Just show free outfits and write orders. We deliver and collect. Advance cash plus huge bonus to 40%. Big money spare or full time. Become manager—appoint others to sell for you. Man or woman, young or old, beginner or veteran, you can earn more money than you thought possible. Everything needed given free. Rush name and address to Kendex Corp., Babylon 84, New York.

MEXICAN feather pictures. Sell on sight; 200% profit! Free details; sample 10c stamps. Sylvia-SO, Apartado 9036, Mexico City.

MAKE Money Easy. Sell Christmas Cards, 21 for $1.00 and others, children's books, personalized cards and stationery note paper, wrappings and novelties. Send for samples. Howard P. Ellis, Dept. PS-8, Pitman, New Jersey.

$3.00 AN hour selling cushioned shoes direct. Advance commissions. Bonus. No investment. Experience unnecessary. Free outfit. Samples. Paragon Shoes, 738 Columbus, Boston, Mass.

CHRISTMAS Cards At Jobbers Prices! Large selection dollar assortments 35c each in hundred lots. Imprint Cards, Money Folders, Gift Cards, Ornament Books, Pictures, etc. Make more profits selling our line! Catalog free! Three sample boxes $1.00. Elfco, 438 North Wells, Chicago 10.

$250 WEEK reported. Free book "505 Odd, Successful Businesses," Expect something Odd! Pacific-6, Oceanside, Calif.

GO Into Business For Yourself. Make storekeepers' profits without storekeepers' troubles. We'll put you into business, furnish everything you need, train you, carry stock for you, without your investing one penny. We'll work to make you a success. We've done it for others. We'll do it for you if you are honest, ambitious and willing to work hard. Write. You'll hear from us at once with facts. Address, Manager, P. O. Box 335-F18, Chippewa Falls, Wisconsin.

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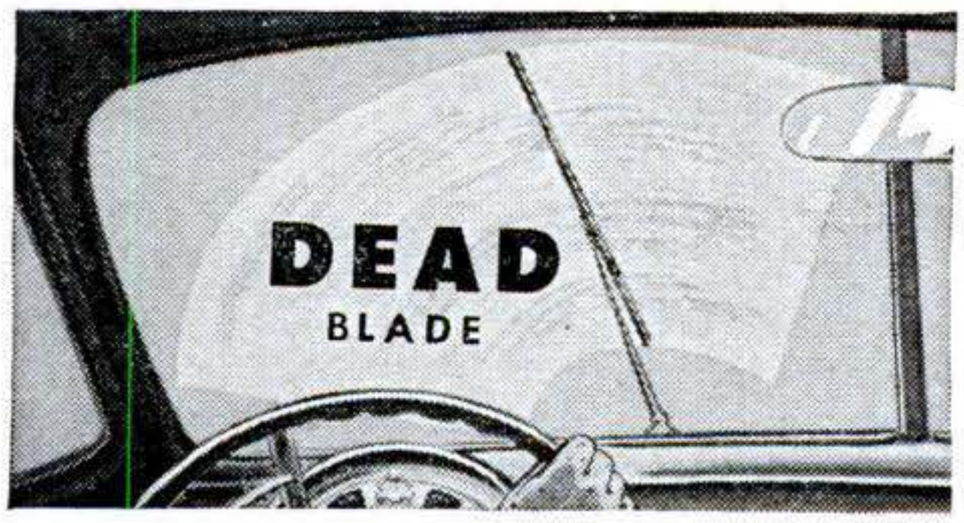

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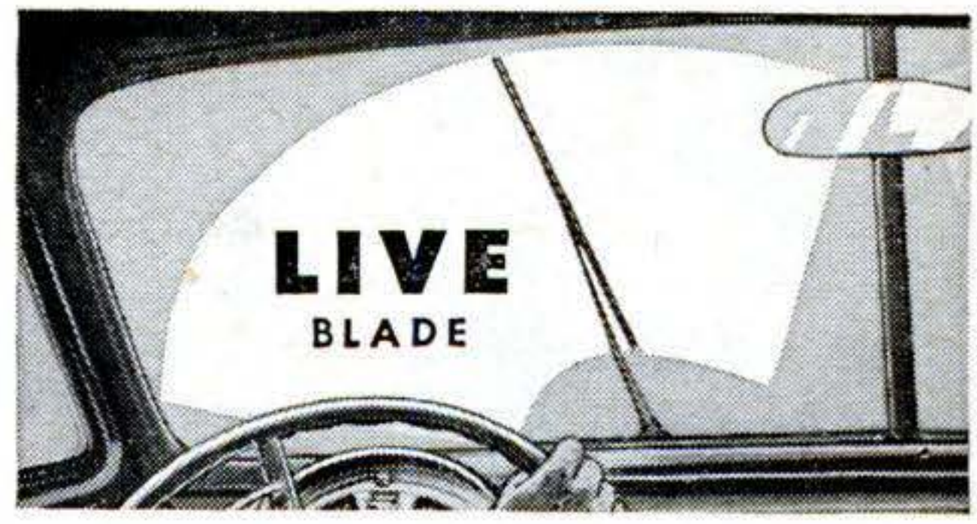

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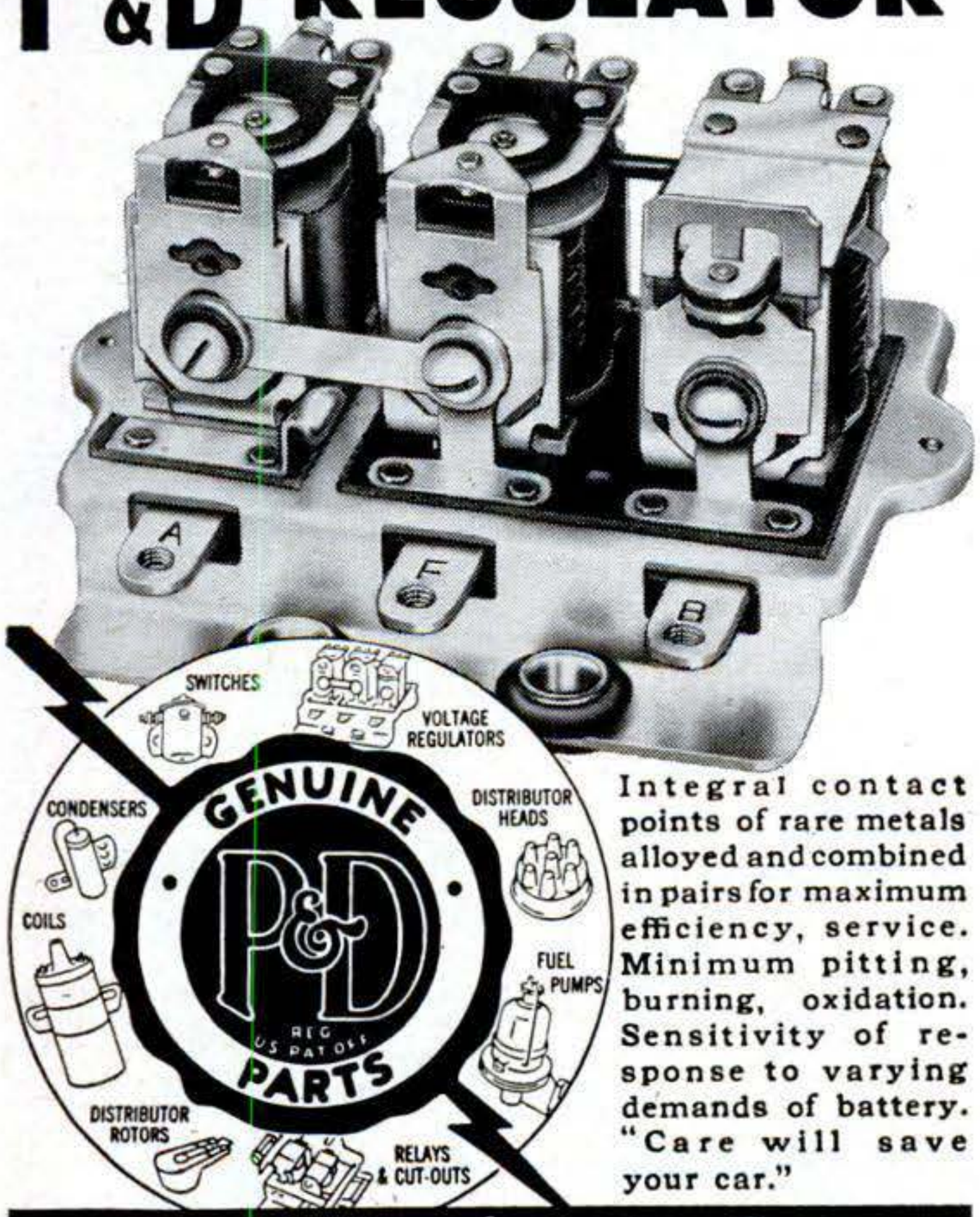

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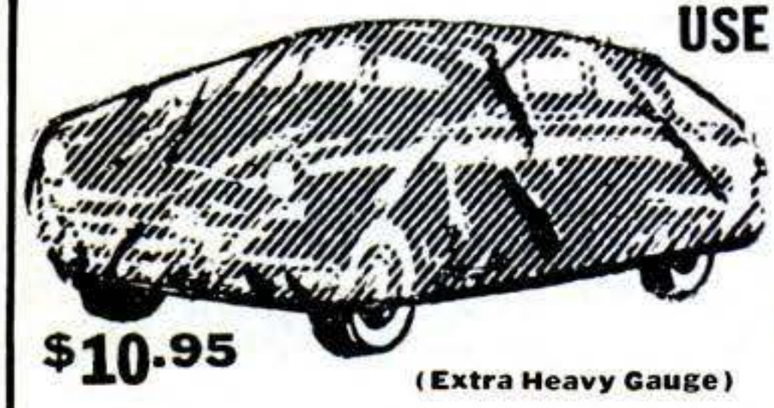

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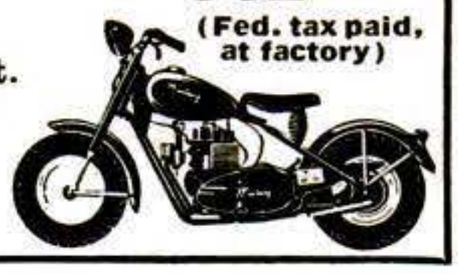

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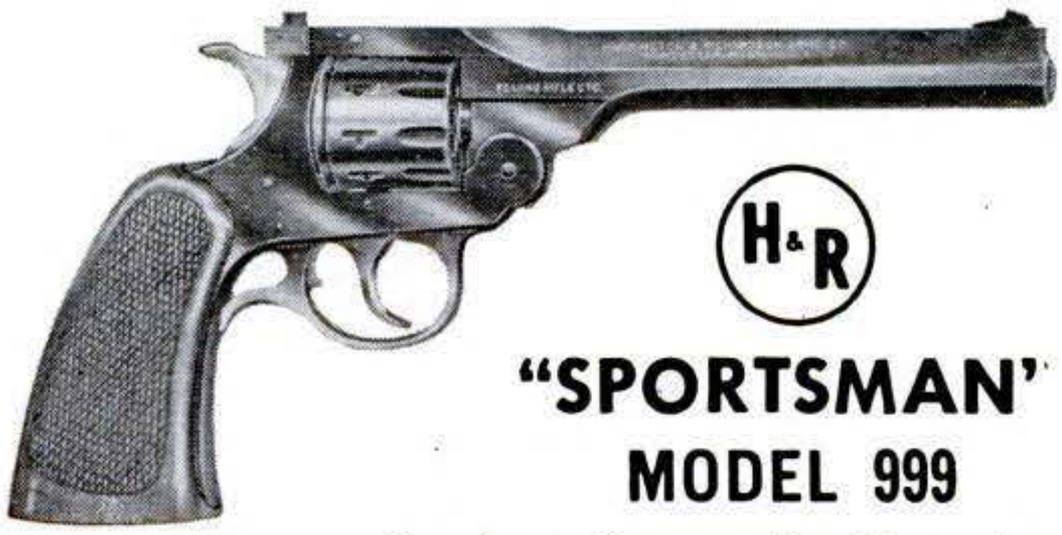

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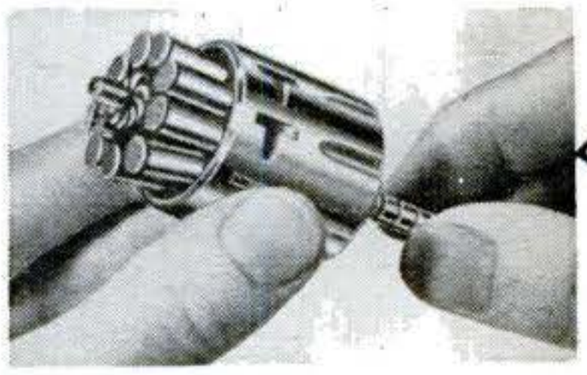

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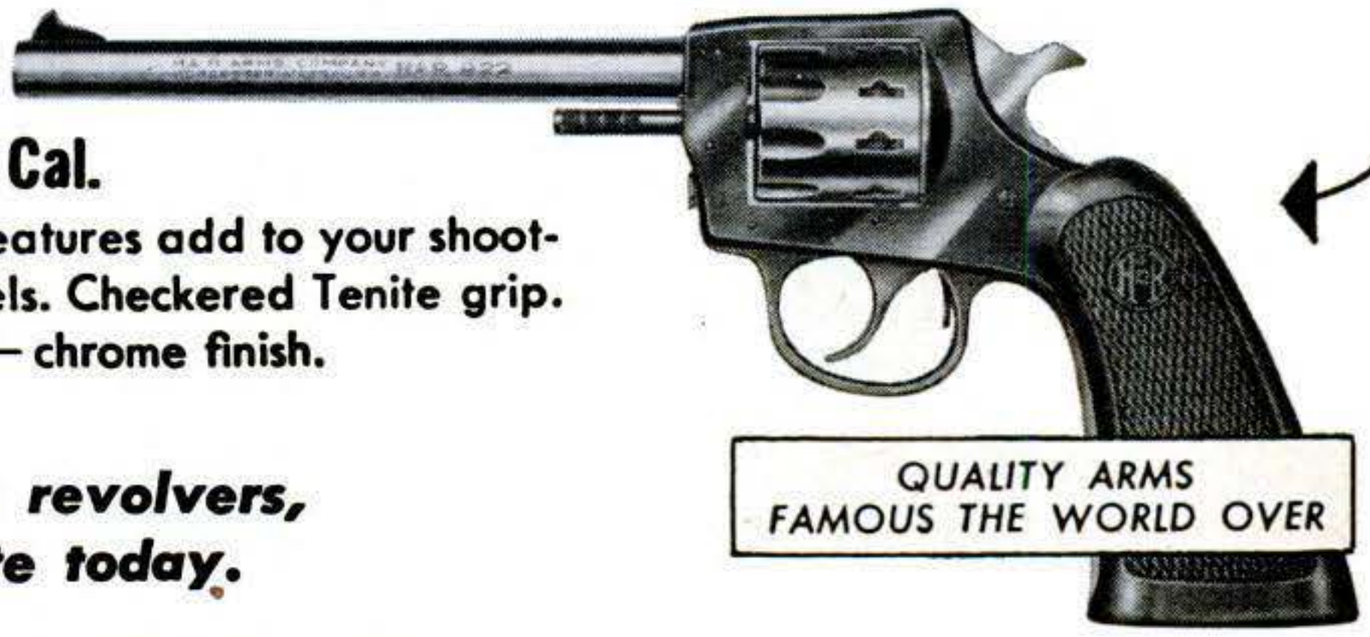

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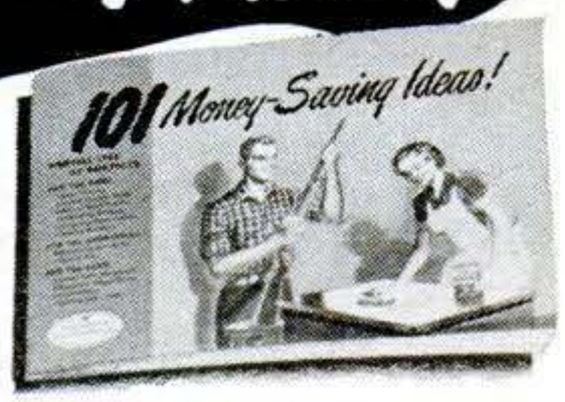

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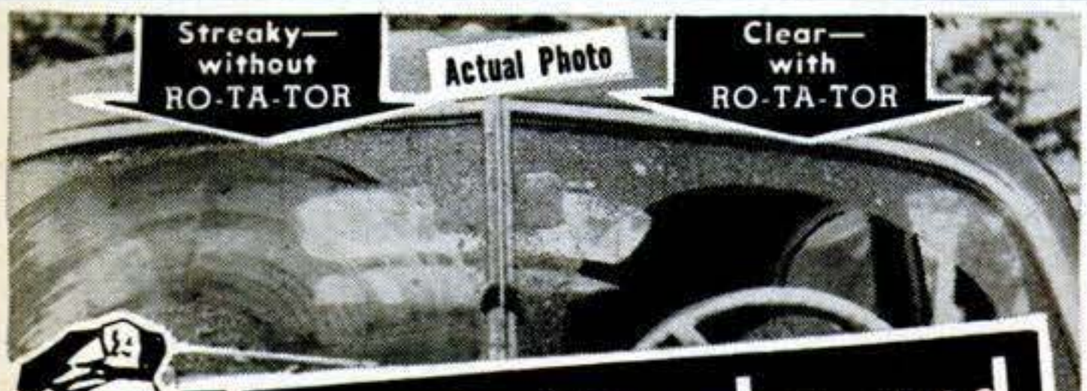

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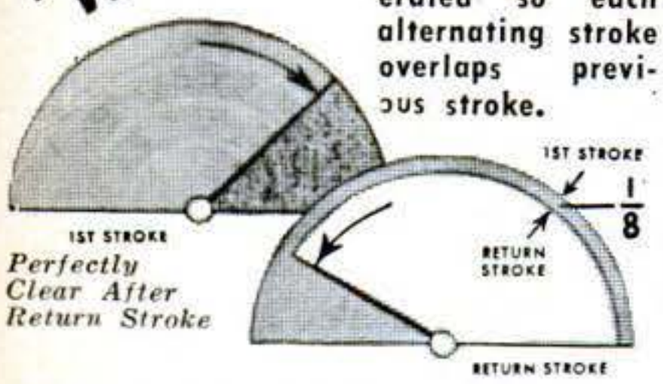

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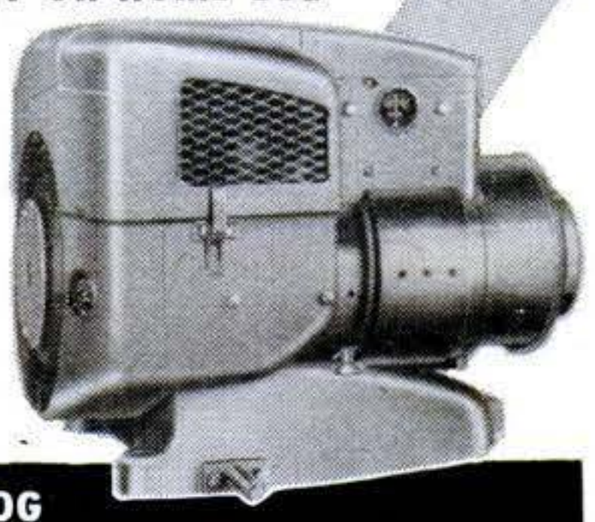

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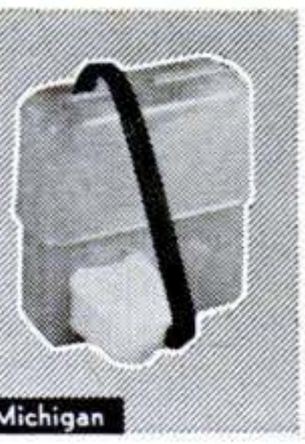

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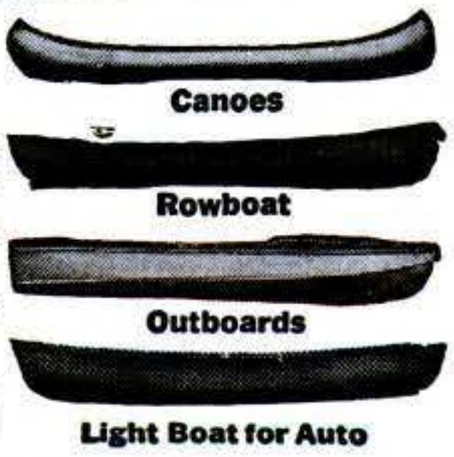

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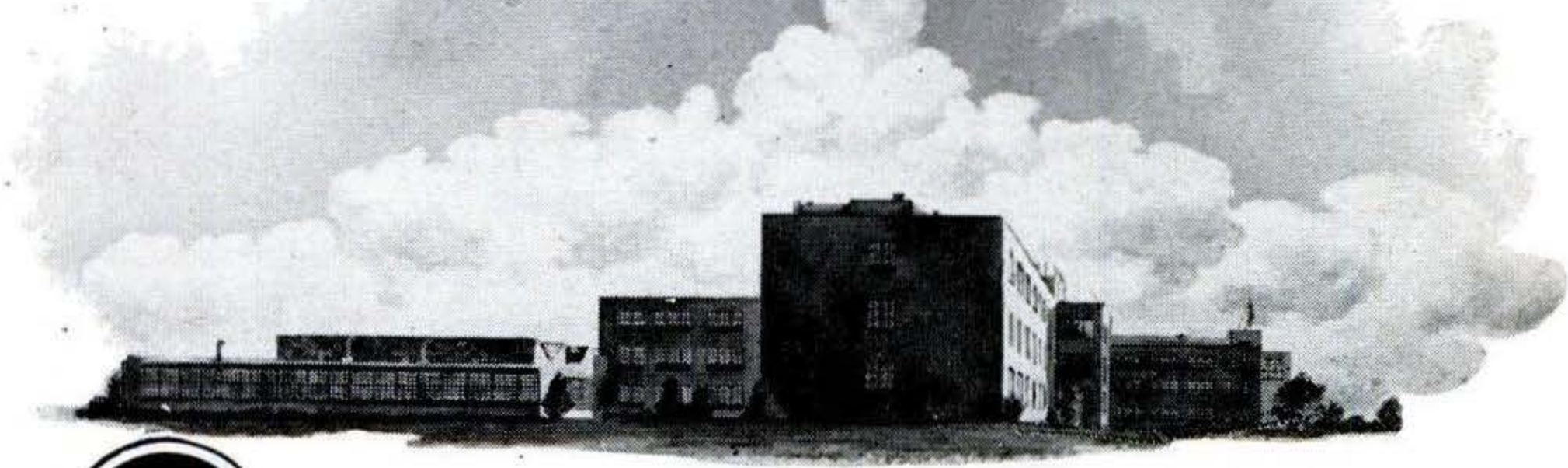

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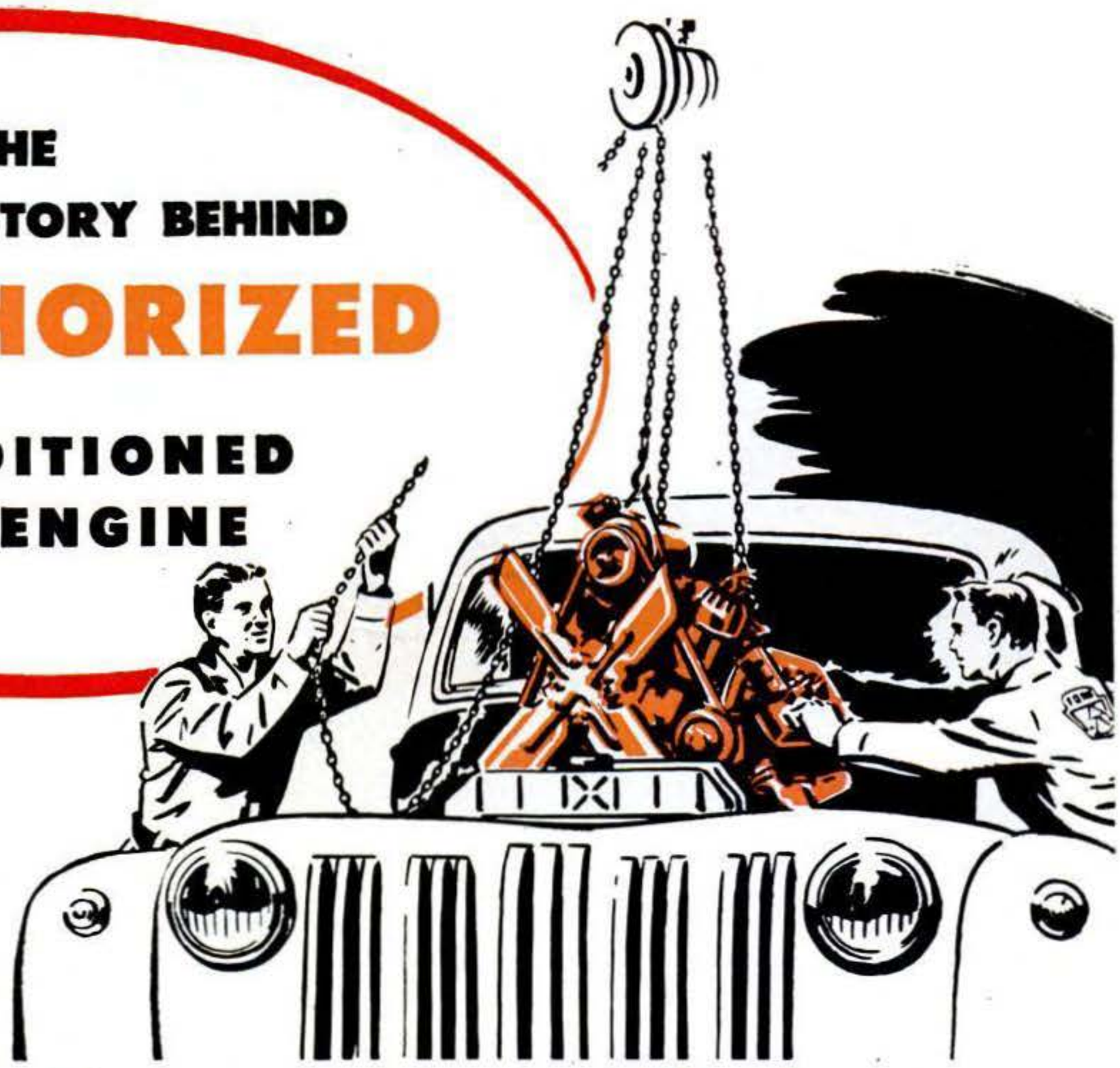

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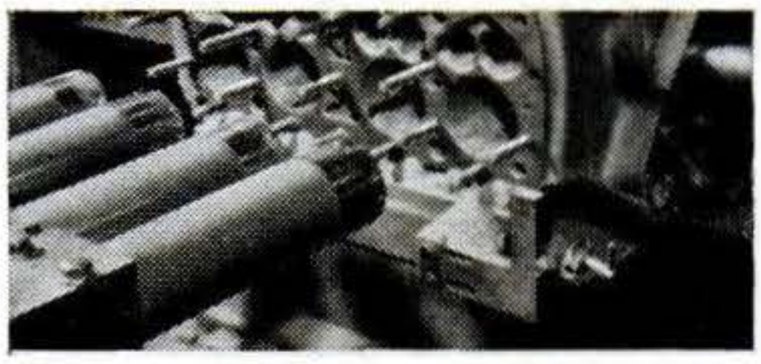

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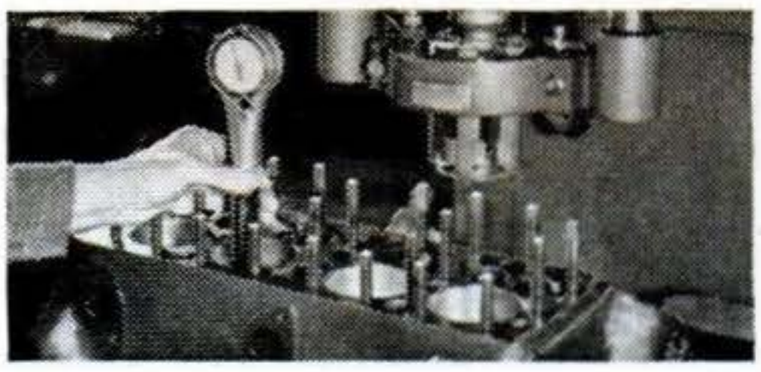

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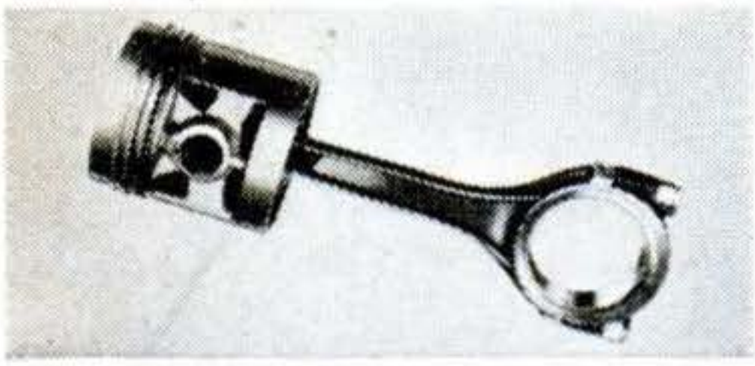

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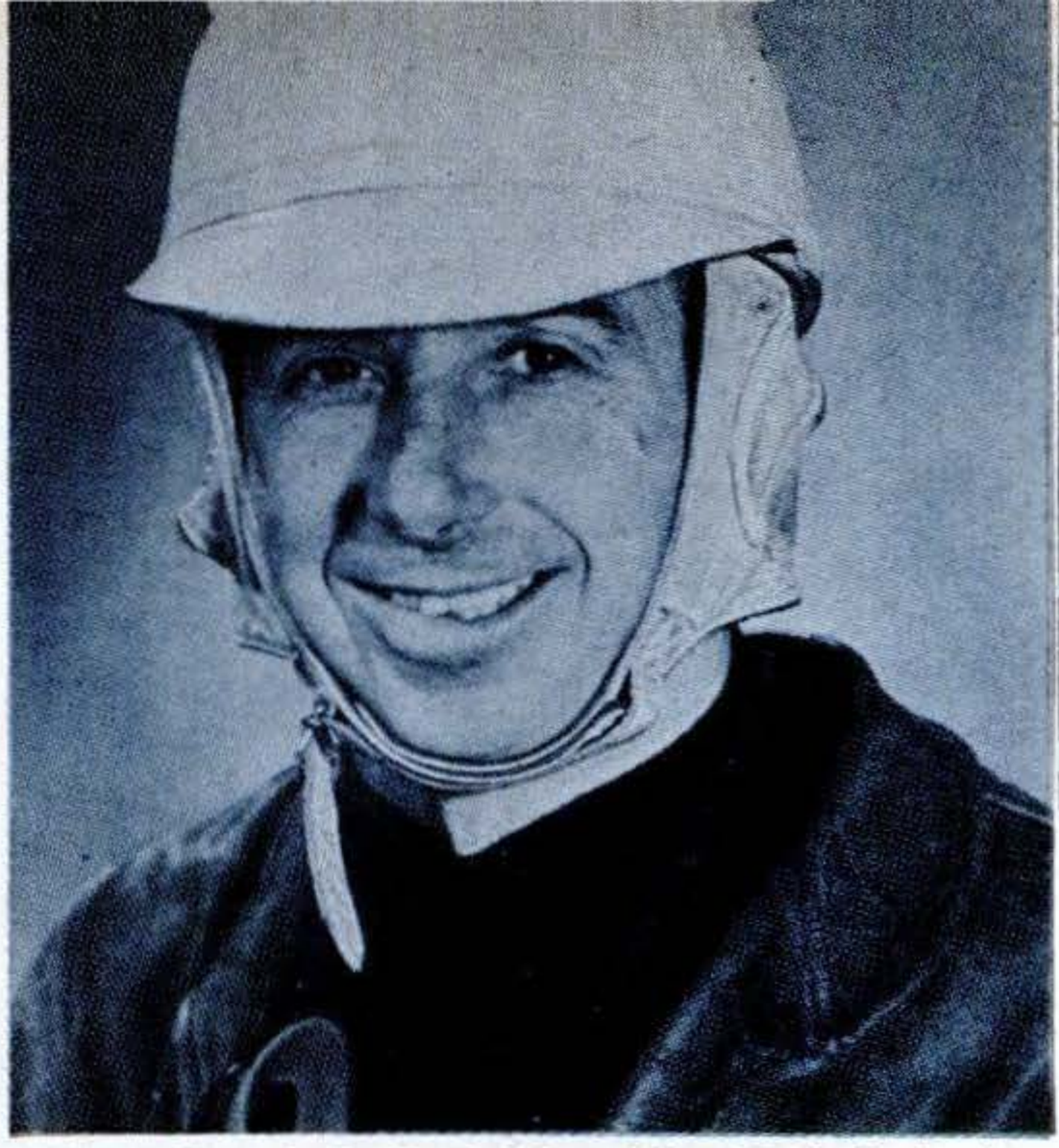
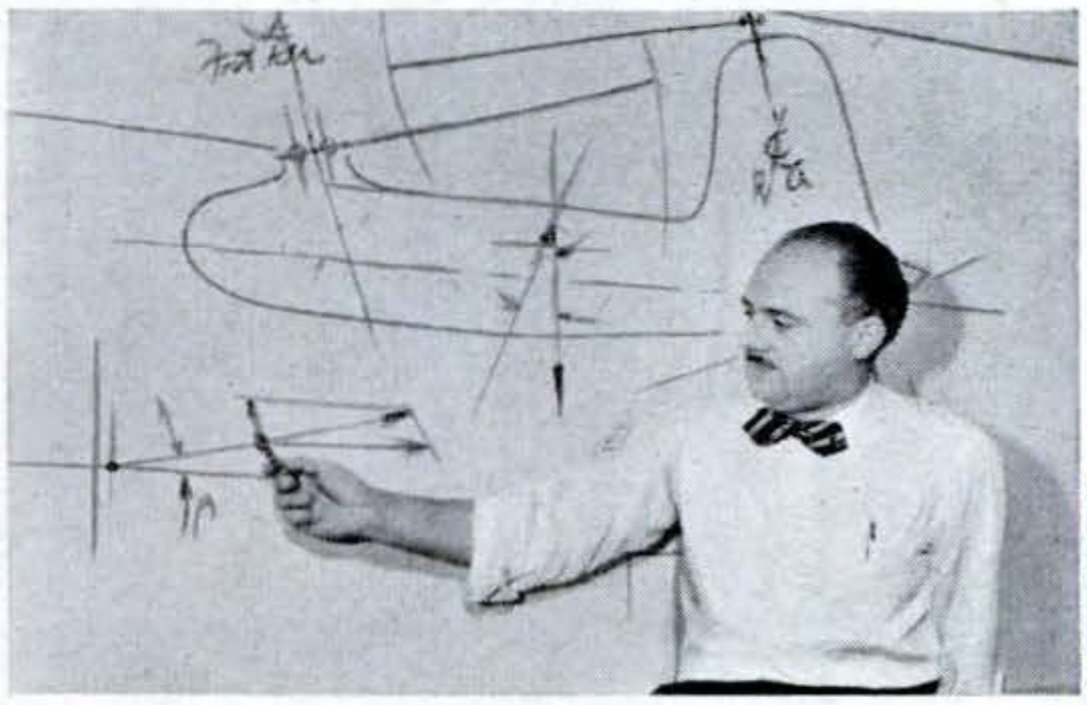


Wilbur Shaw tells the tricks of the trade that win auto races for AAA National Champ Henry Banks (above) and other ace drivers. Page 66

New shadowed concrete blocks give a clapboard effect to this roomy garage and workshop. These directions tell you how to build it. Page 145

Popular Science *Highlights* This Month



Boy-wonder Frank Piasecki's rise has been almost as vertical as that of his revolutionary helicopter —"The Flying Banana." Page 129

Devon Francis climbs into cab of world's fastest train—the Twin Cities Zephyr—to report a "head-end" ride on a rocket on rails. Page 79

Pulling firepower out of thin air for the infantry is the job of the Forward Air Controller, a pilot who doesn't get off the ground. Page 92

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This looks bad, but the car came down and went on to finish second in this race at Atlanta.

The "fastest" car doesn't always win. It's skill, stamina—and a bit of luck—that really pay off in racing.

By Wilbur Shaw

I WRECKED a racing car a few years ago for what—to an average motorist— would be a downright silly reason.

I was driving too slow.

That automobile was my pride. I'd built it. My wife, Boots, and I referred to it as the "Pay Car" and the "Family Jewels." Every cent we owned was in it. And what did I do? I rammed it into the wall at the Roosevelt raceway on Long Island.

I had just come from the 500-mile Memorial Day race at Indianapolis. There, I had had to make a 17-minute pit stop that lost the race. An oversight by the body builder, who had left out three cents' worth of rivets, cost me $30,000.

Now, on the Long Island track, I was determined to make up for my failure at Indianapolis to win some money with my spanking-new, streamlined car.

I "Lost It" on the Turn

Everything was going fine. I eased into a turn. Suddenly I "lost it." The car went straight toward the wall. It hit. It crumpled. When the dust settled, I was sitting there hanging to a steel steering wheel bent double.

My speed had been too low, considering the condition of the track and the radius of the turn, for me to retain control of my car with my throttle. My rear wheels took charge instead of the front. And when that happens, brother, you've had it!

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Almost all the art of racing on tracks—and it's really more of an art than a technique—is wrapped up in making a turn. Any man with good eyesight and normal reaction time can drive a racing car down a straightaway.

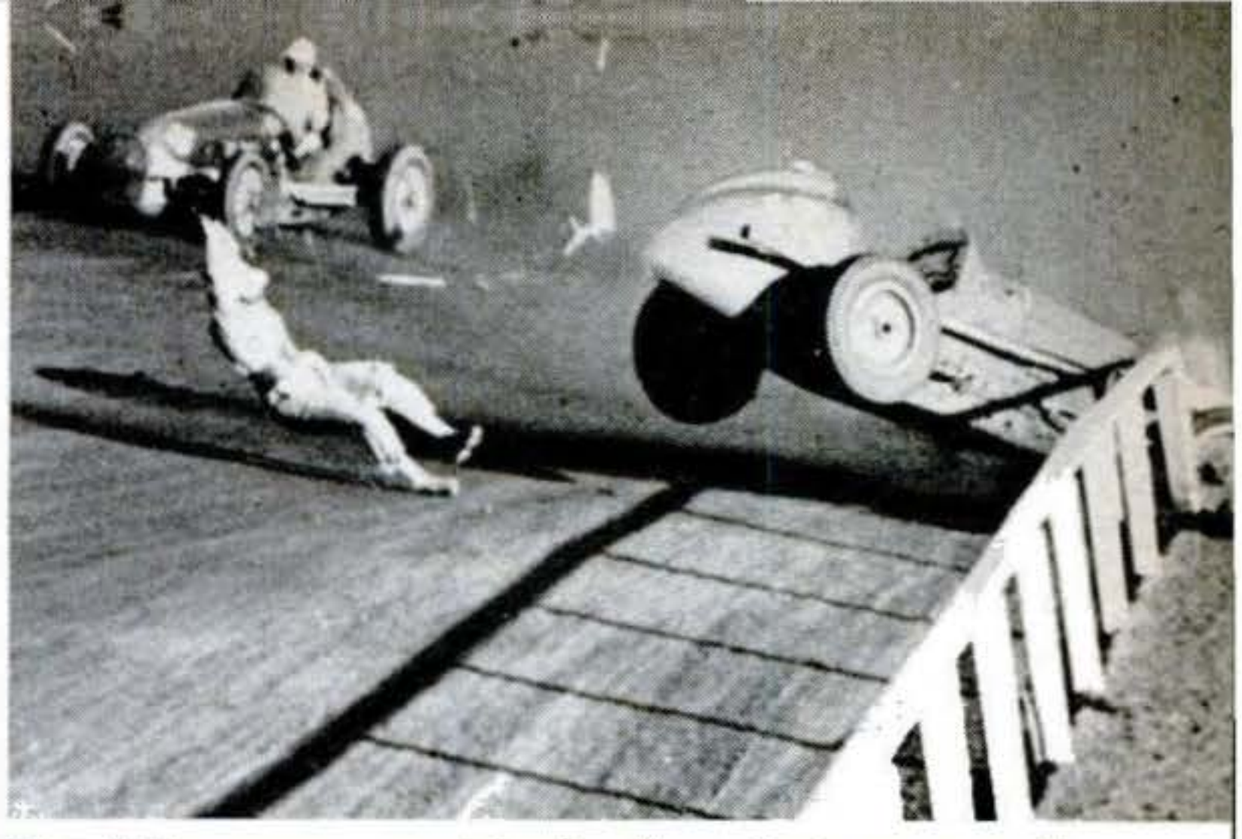
It's the turns that separate the men from the boys.

Skilled Drivers Shun Brakes

Here's why: A driver uses his brakes very little. Your control is mostly in your steering wheel and throttle. You pitch your car into a turn, easing off on the throttle as you leave the straightaway, and then you skid around the turn with the throttle. You *steer* with your throttle. Drivers now use their brakes more than they used to, because they are driving deeper into the turns with full throttle. But brakes are not necessary if you use good judgment and ease off in time.

As you may know, racing cars have no differentials. If it weren't for a differential, you couldn't drive your family sedan in anything but a straight line without wearing the rear tires out. But in a racing car it's different.

Fit a racer with a differential, and you could wreck it—but fast. If one of your rear wheels left the ground at 150 miles an hour, it would spin—and the other wheel would be left without any power whatsoever.



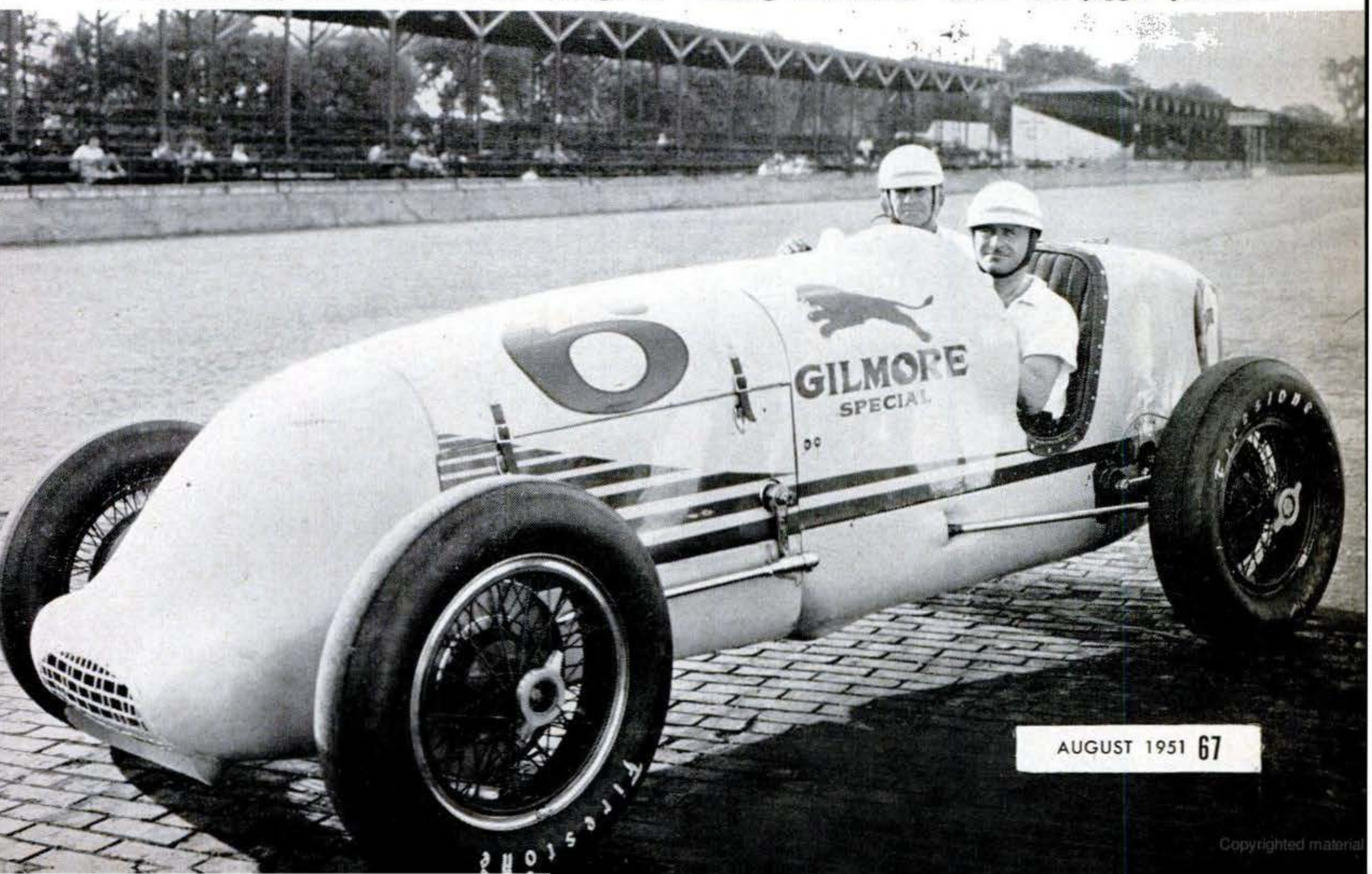
Fatalities are surprisingly few, but now and then they happen. Rex Mays, thrown from car, was killed in this crash at Del Mar, Calif.

So, in effect, the driving axles of racing cars are as solid as those of a railroad coach.

In making a fast left turn, the left wheel of the driving axle usually is off the ground or nearly so. But the driver still has power on that right wheel for traction and control. (All races are run counterclockwise on the track in this country.)

When you close your throttle just before a turn, your rear wheels—if you're driving a rear-drive job—want to skid. And you want them to skid—it's the only way you can make the turn fast. The skidding results

My "pay car" introduced streamlining to racing. It won me my first "500" at an average of 113.58 m.p.h. in 1937. In those days we had riding mechanics. Mine was Jigger Johnson.



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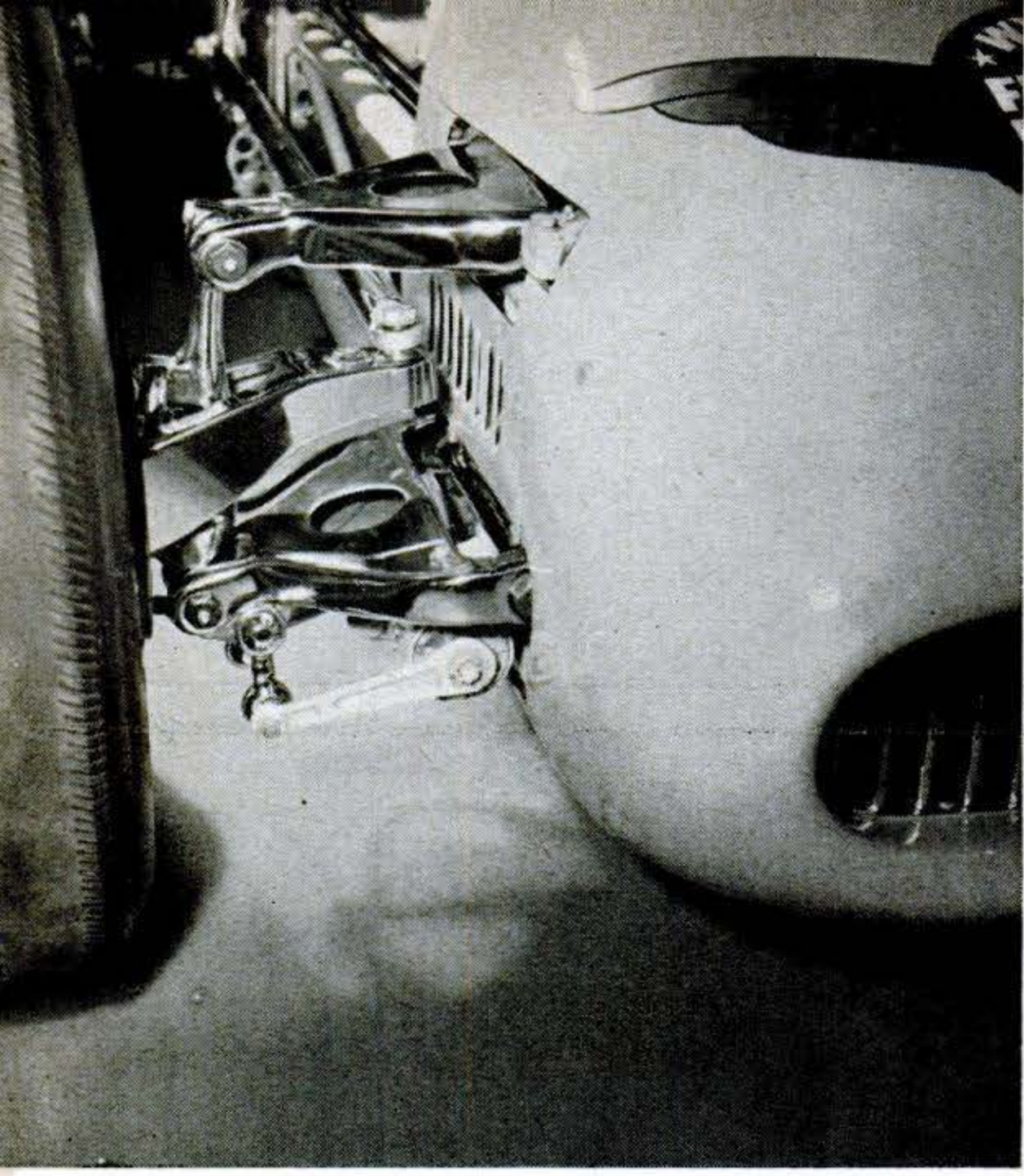

Suspension on Wynn's Friction Proofing Special. This view shows upper and lower spindle control arms, steering arm, spindle support, spindle drag link, and shock absorber.

Racers don't have starters and have to be cranked. Here a Novi is turned over by a compressed-air motor. This supercharged job is a "side-winder"—crank is on the side.

from the tremendous compression-braking of your high-compression engine. Your rear wheels drag their feet.

At this moment you indicate to your front wheels that you want to turn left. You don't *turn* your front wheels. You just nudge them. Your rear wheels, aching to slide to the right, take the hint. Then you're in your turn. To keep your car from spinning or going broadside, you bring your front wheels to the right—just a whisker. That compensates for the skid of the rear wheels and keeps the car going left just the right amount. Then the throttle comes into the act. Ease up on your throttle, and you soften the skid. Press on it, and you increase your skid or left turn. The trick is to keep your car headed around the turn just the right amount. If you don't you lose speed. Lose enough speed, and you lose the race.

The Throttle Does It

It's your throttle that brings you out of a turn into the straightaway clean and true and as fast as the track surface and the radius of the turn will allow.

In my first race, at Lafayette, Ind., I drove a car that had been qualified by another driver.

"How fast will this car take the turns without rolling over?" I asked him.

"She'll slide off the track," he replied, "before she'll turn over."

So, on the first lap, I drove her right through the fence, on two wheels.

Driver Can Make $100,000 a Season

You can start an argument anywhere about how to win a race. That, in fact, is what makes racing the big-money sport it is today. For being right, a crack driver can collect $100,000 in a single season, if he owns his own car.

The car counts. The art of driving counts. The breaks of the game count. A good driver in a good car will always beat a mediocre driver in a good car or a good driver in a mediocre car—given the breaks.

If a man's good, and can qualify, he kicks off the season with a car tuned to a razor edge of performance by competing in the Indianapolis "500." From there on, he makes the circuit of the championship dirt tracks.

This year in June and July, he competed at Milwaukee and Darlington, S. C. This month he will race at Springfield, Ill. By November, he will have driven at Du Quoin, Ill., Syracuse, N. Y., Detroit, Sacramento, and Phoenix.

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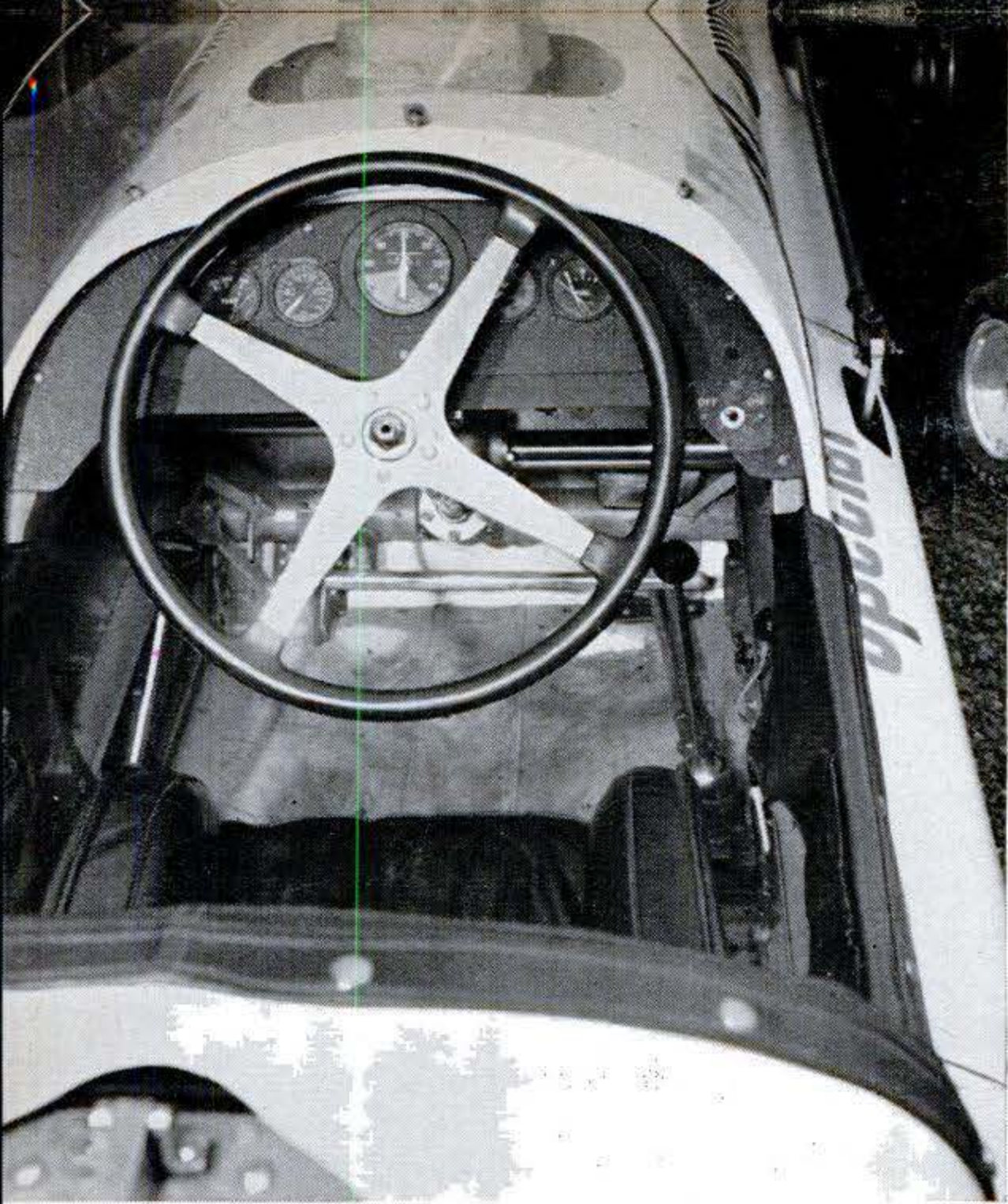
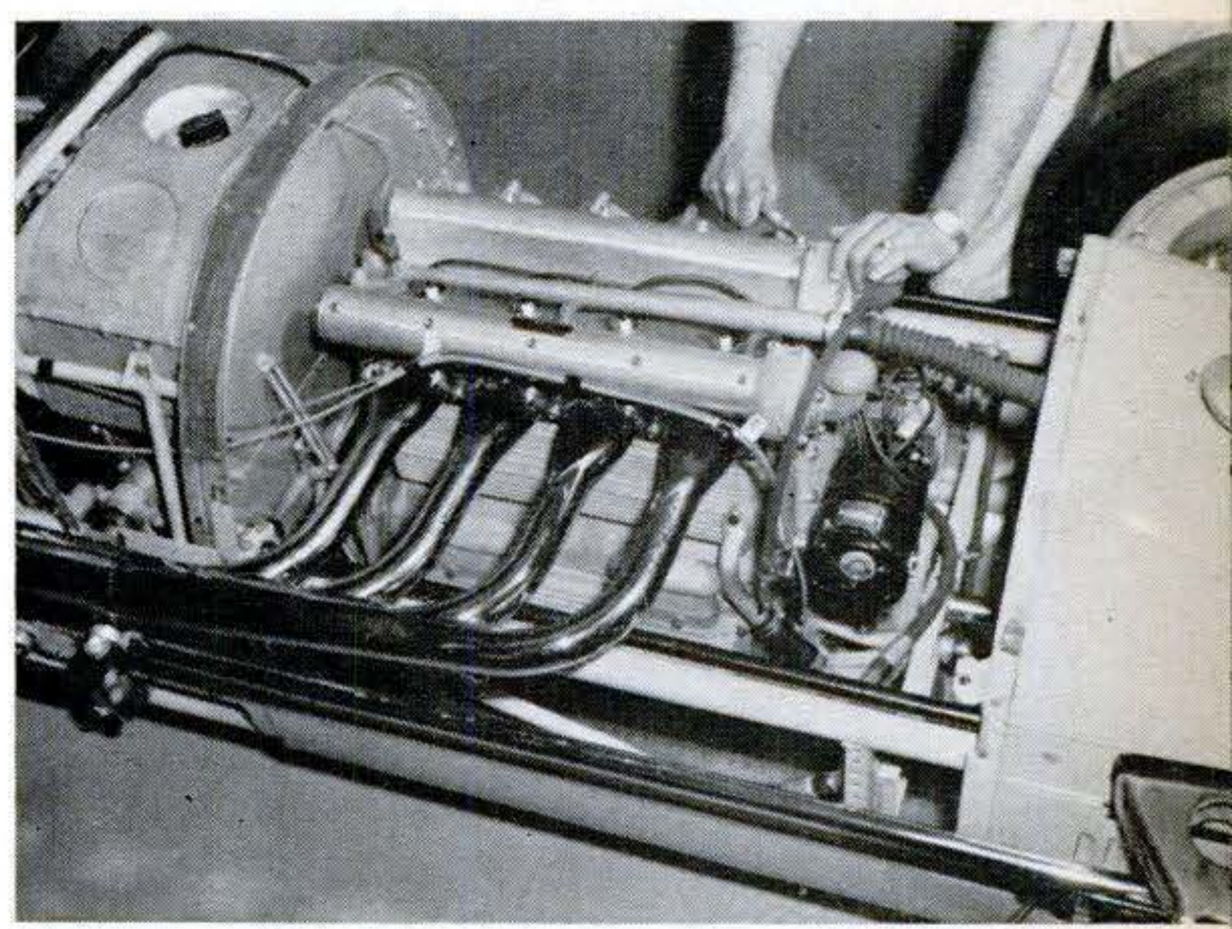


The Novi's cockpit, strictly functional, is typical. Most prominent instrument counts engine r.p.m.'s. Others show oil temperature and pressure, engine heat, and fuel level.

Wheels are either wire or magnesium disks like these on driver Sam Hanks' racer. In championship racing, cars are required to have three forward speeds, reverse, and four-wheel brakes.



Engine in the Wynn racer is a Meyer & Drake, built in Los Angeles. With four unsupercharged cylinders, it has a bore of 4 5/16 in., a stroke of 4⅝, and delivers about 330 hp.

The automobile-racing championship is determined by the point system. For every win, a man gets two points per mile. For lower positions at the finish line, the points are graduated downward.

Championship racing is the only kind in which a man has a chance to win real money.

Many a good driver has started as an "outlaw" on the half-mile "horse tracks" and "bull rings" in events not sanctioned by the American Automobile Association. I've been an outlaw myself. But for the championship, a man must race in events where certain rules of safety and sportsmanship are enforced by the AAA.

For the championship races on the mile tracks—events of 100 to 200 miles duration—you have a car with a compression ratio as high as 15 to 1. The engine has cost, say, $6,000 to $7,500, and the entire vehicle from $10,000 to $100,000.

If your engine has four cylinders, it probably will produce 300-odd horsepower at 5,500 revolutions a minute. It has twin carburetors and two inlet and two exhaust valves for each cylinder so it will "breathe" easily at high speed. It has domed combustion chambers, like the new Chrysler. It can be "blown" or "unblown"—with or without a supercharger. And it must be a rear drive to perform well on a dirt track.

Your racer's pistons will be so loose that they slap the sides of the cylinders when they're cold. The pistons are solid-walled for strength, and they expand a lot under heat. Thus they must have extra clearance. That big clearance, and the heat, require a heavy lubricating oil, about S.A.E. No. 50.

The plugs will be of the "cold" type to accommodate the heat of high compression.

Alcohol and Gasoline Do Mix Here

Your fuel may be your own secret mixture. There's a lot of hocus-pocus in the pits over fuel. But most of it is pure methyl alcohol or an alcohol-gasoline mixture. The great advantage of alcohol is that it burns without pinging. Its disadvantage is that you get only about three miles to the gallon out of it.

Your car frame will be a rectangle, of tubular steel, or of box-section steel U-chan-

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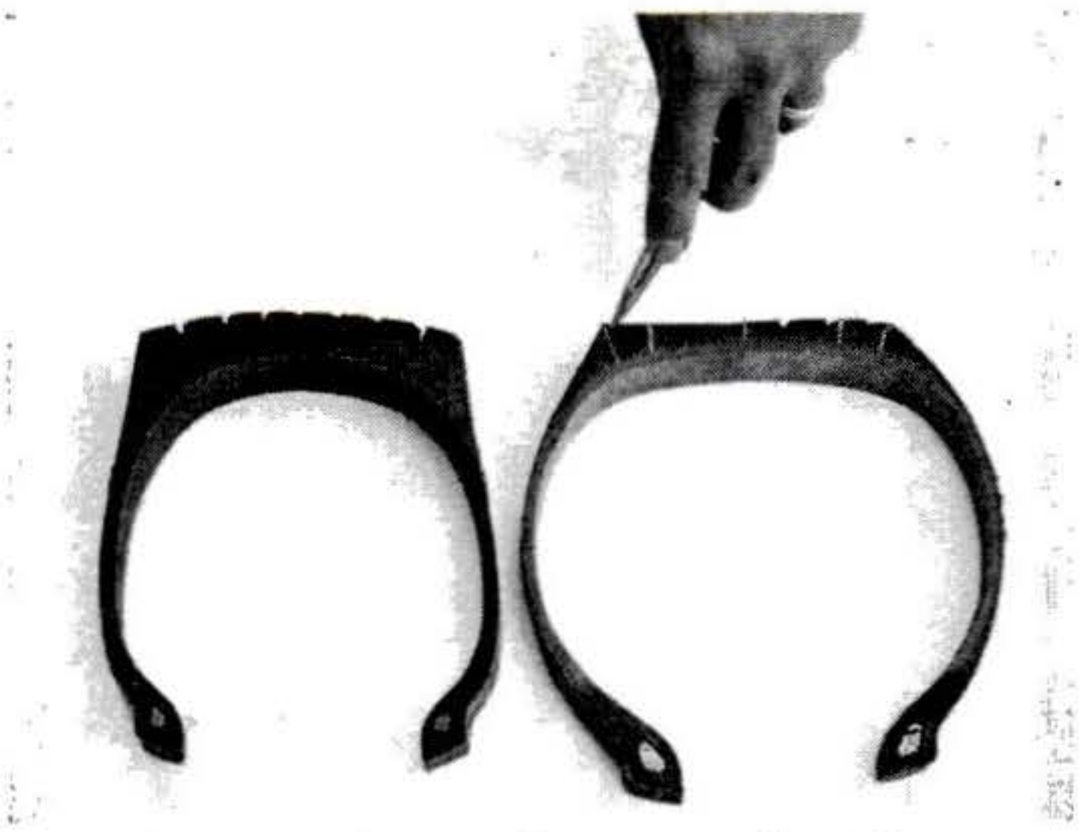

Tires have little tread compared with a passenger-car tire, shown at left in this sectional view. Pencil shows the lip molded on the side that takes the scrubbing in turns.

neled from flat stock and boxed by welding a plate on the open side. There will be four, five, or six strengthening cross-members. An X-type frame, commonly used on passenger cars, would consume space needed to undersling the transmission and engine.

To save weight, the wheels will be wire-spoke or magnesium disks with wide rims. The tires will have a special tread for dirt tracks. Firestone makes all of today's racing tires with the exception of midget sizes.

Your car will do 150 to 160 miles an hour on the 3,300-foot "chutes"—the straightaways—of the 2½-mile Indianapolis Speedway and average better than 120 for 500 miles. On the shorter dirt tracks, you'll get to 125 and average 90 to 100.

Car Is Changed to Race on Dirt

For dirt-track racing, your car undergoes a lot of changes not required by conditions on a hard track. You want your right front and rear tires to dig in and limit your skid. So you raise your center of gravity by twisting your torsion-bar suspension rods a notch or two, or, if the car has springs, by putting on springs with more arch in them.

Your steering ratio on pavement has been, say, 14 to 1. You need much faster steering on dirt, so you use a gearing of 6 to 1. You want your engine to "peak" by the time you're halfway down the stretch, so you change your axle gear ratio. On a hard track you've used perhaps 3.30 to 1 with 18-inch wheels. To get acceleration on dirt, you switch to 16-inch wheels and an axle of better than 4 to 1. You stiffen your shocks for better ride control because dirt tracks are rougher.

To win, even with the best car money can buy, you must know the fine points of racing. You must know, for example, how to keep your car from "drifting"—skidding excessively—on a turn. You must know the rules. You must know that if you "cut in" on a fellow driver, to the jeopardy of everyone in the race, you will be yanked off the track so fast it will make your head swim.

Car and Driver Become One

You're human, keyed up and possibly irascible before the race starts. You have to grit your teeth to overcome your eagerness. Your car is as much a part of you as your arms and legs. It's alive. You know how it's going to act under any given track condition. You can anticipate its behavior from one split-second to the next. You almost will it around the track.

One of the greatest all-around drivers I've ever seen on dirt tracks or on the Speedway is Lee Wallard, winner of this year's "500." Lee is a true sportsman. Name me a race driver who isn't, and I'll name you one who never got anywhere in the game.

You try hard to win. But even so, sometimes you're more surprised than anyone else when you get the victor's checkered flag at the finish line.

Hare-and-Tortoise Story Re-enacted

In one race when I thought I had a dirt-track event in the bag, I deliberately eased off on the throttle. I had had the white flag for the last lap, was in the stretch, and the field was clear. Suddenly I felt someone behind me.

You hear competition in racing, but you feel it, too, like a ghostly presence.

Another car was streaking down on me. I was going too slow to accelerate enough to keep my lead. My foolishness was just about to cost me the race.

The man behind just couldn't do this to me. I squirmed around in my cockpit and bared my teeth and shook my head.

I'm still wondering why he closed the throttle and let me win. END

This Month's Shaw-ism

Drive with your head instead of your horn.

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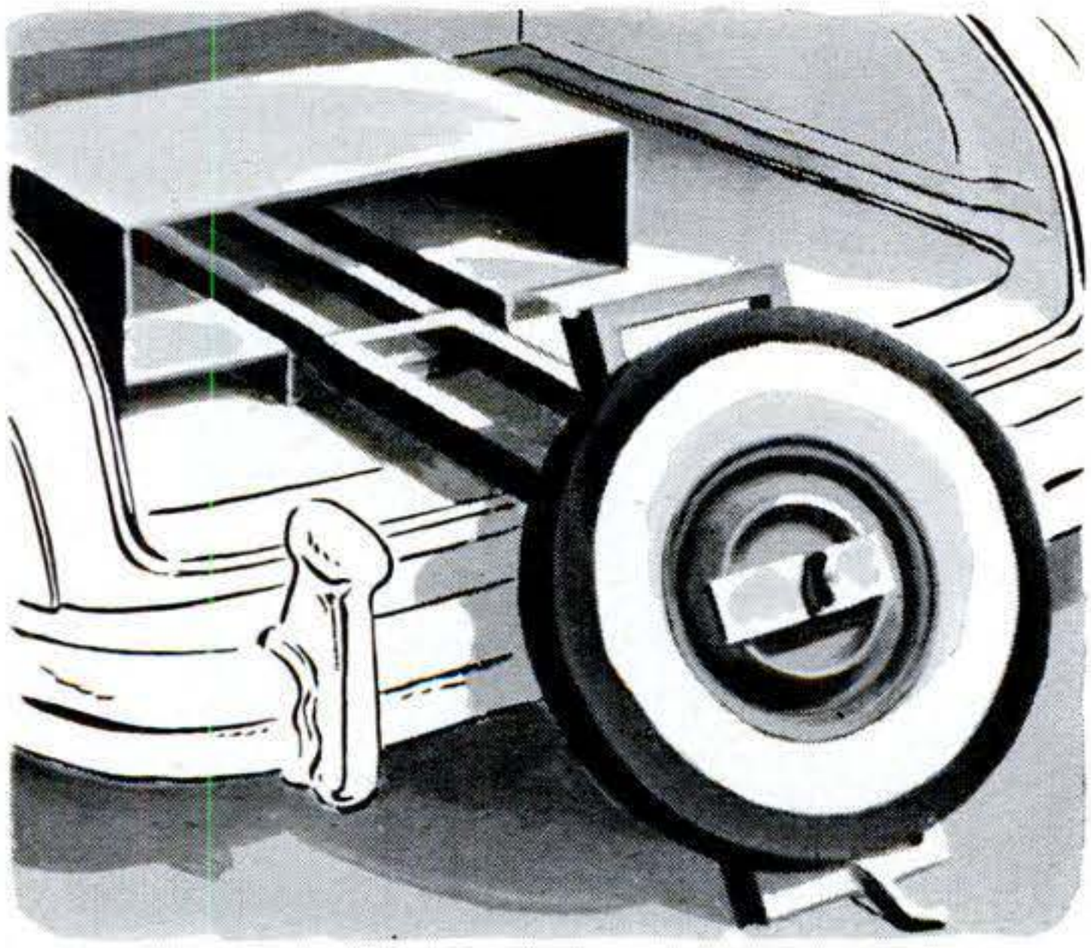
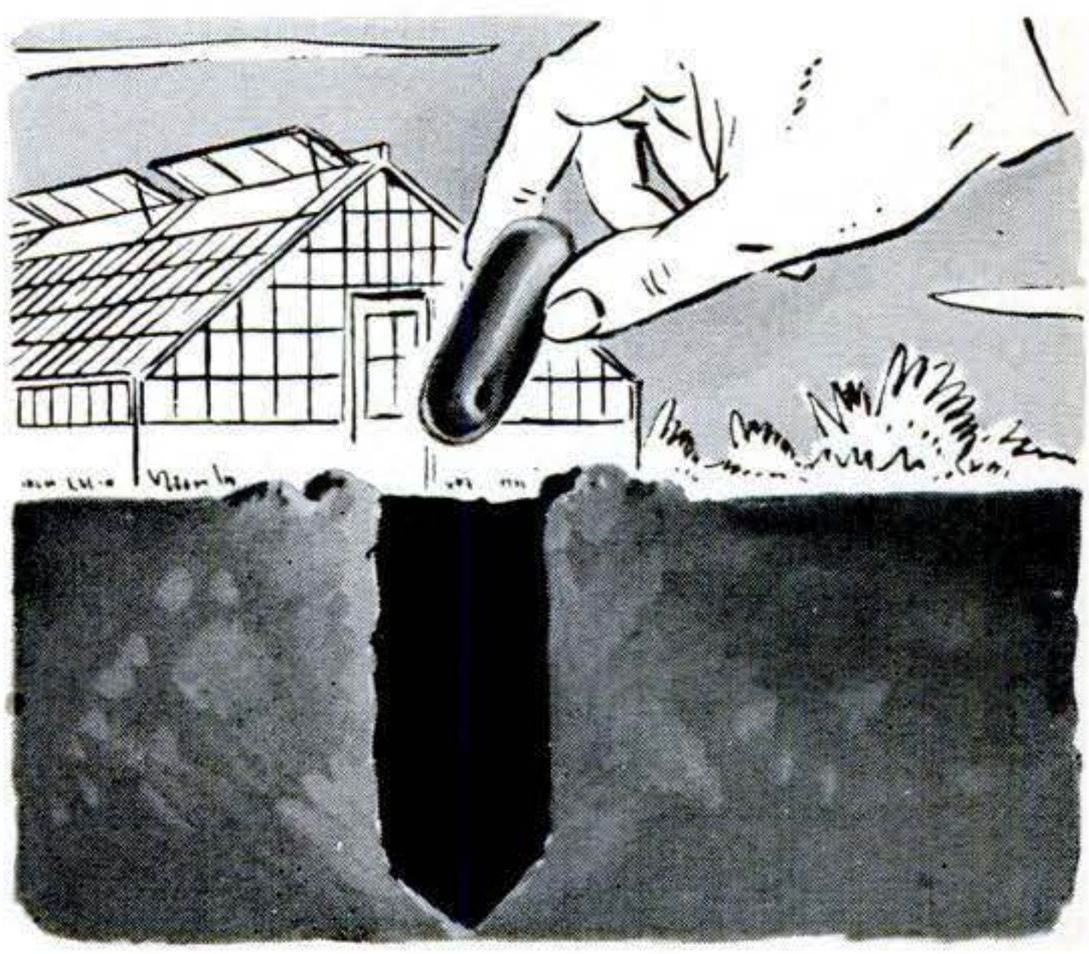
New Ideas from the Inventors

1 Dock to Beach Seaplanes. When the water is too rough to allow a seaplane to be berthed and loaded at the wharf (top inset), this dock could be submerged, the seaplane floated into place over a dolly, and the dock raised out of the water by hydraulic jacks. The plane then would be rolled ashore to fit between two adjustable loading platforms that are wheeled up snugly against the plane's fuselage.



2 Spare-Wheel Rack to Pull Out. Removing the spare wheel from a car's luggage compartment would be no back-breaking chore with this pull-out rack. The wheel is held on a telescoping frame that slides out beyond the bumper. The section holding the wheel is pivoted so it can then swing down to bring the wheel upright.



3 Pill to Fumigate Soil. Soil fumigants that are dangerous to breathe could be used without wearing a gas mask if they were encased in these capsules. Such fumigants are used to rid soil of insects and larvae. These capsules would dissolve and release the fumigant beneath the surface after you had buried them.

Turn the page, please, for three more new ideas.

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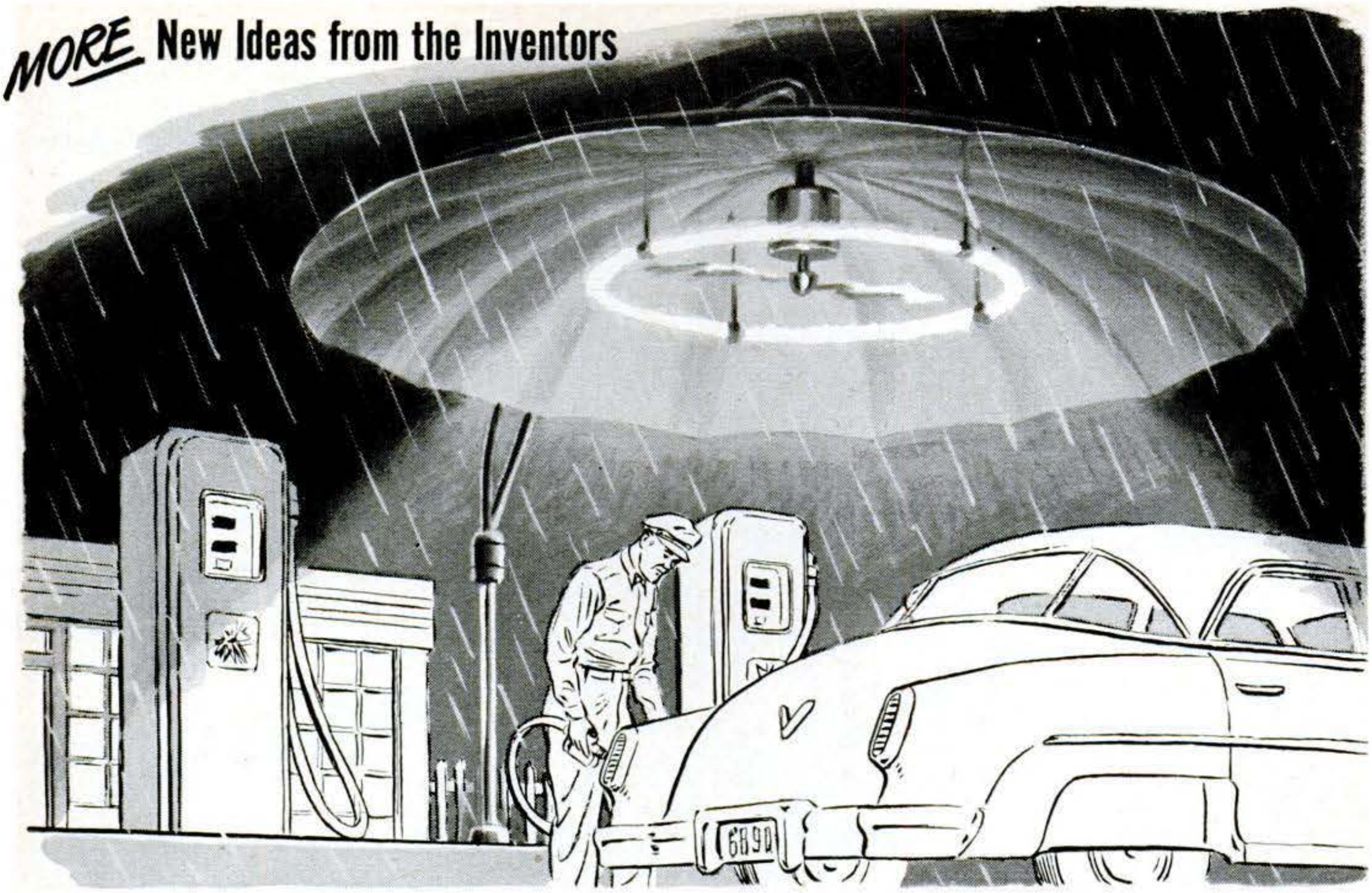
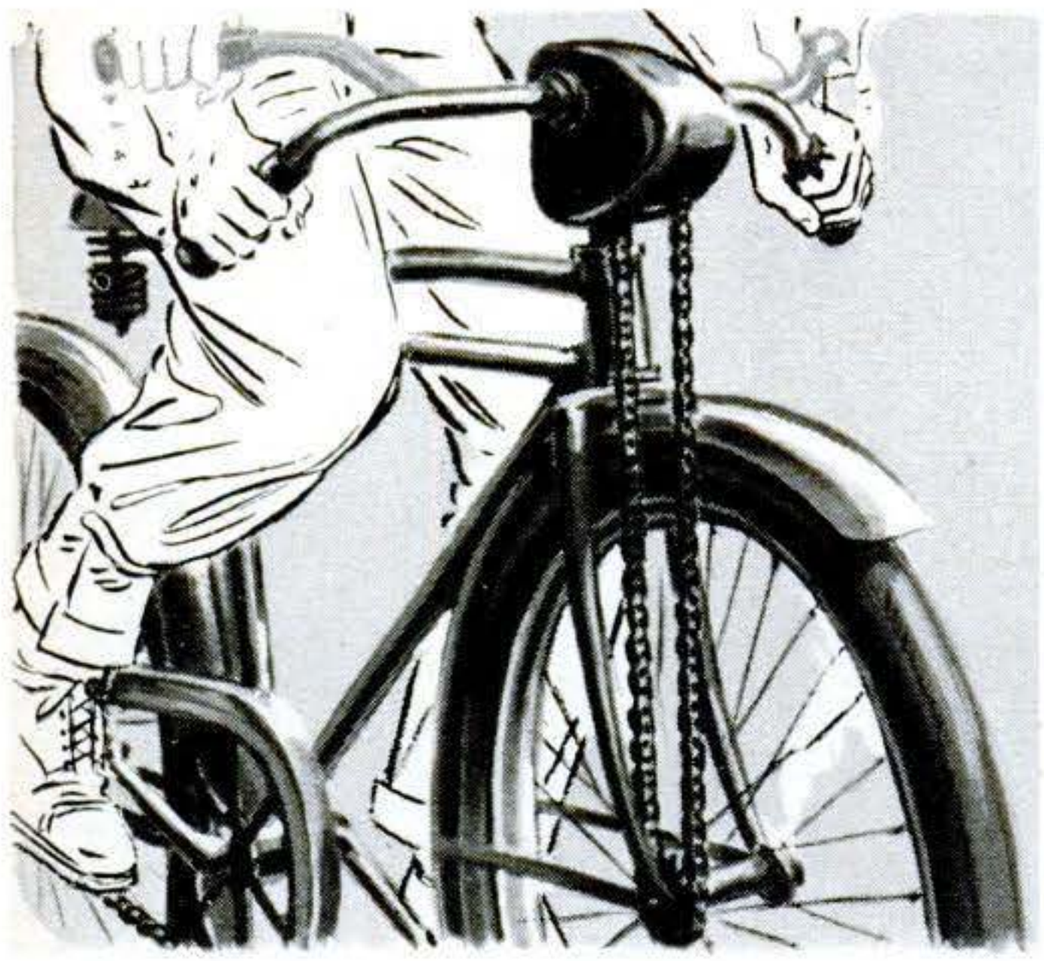
MORE New Ideas from the Inventors



4 Canopy to Shield Gas Pump. Here's an invention intended to make life pleasanter for a gas-station operator on bad days. This canopy would not only protect him from the rain but also illuminate the area around the pump—and there's an electric fan in it to keep gas fumes from collecting beneath it. Mounted in the center of the pump island, the canopy is pivoted so it could be swung to either side as needed.



5 Handle Bars to Pump Bike. A cyclist could use his hands as well as his feet to gain speed on a bicycle fitted with this front-wheel drive. The pivoted handle bars are pumped up and down alternately to operate a ratchet-and-pawl mechanism that drives the chain. The handle bars can be locked when drive is not needed.

6 Brush to Double as Blower. If you couldn't brush it away, you could blow it away with this shop brush. It has a hollow-rubber bulb molded over the handle for removing chips and other dirt from hard-to-get-at places. Squeezing the long rubber bulb forces a blast of air out of a small nozzle in the tip of the handle.

Patents on these inventions have been granted to: 1. W. Turnbull, Towson, Md.; 2. C. Lundgren, Bonaparte, Iowa; 3. W. Kay, Grosse Pointe Park, Mich.; 4. J. Wellen, Pittsburgh; 5. T. Saxer, Rorschach, Switzerland; 6. V. Potholm, Hartford, Conn.

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For record flight, Skyrocket takes off from belly of B-29 mother plane flying at 35,000 ft.

Flying "Out of This World"

WHEN test pilot William Bridgeman recently zoomed his Douglas Skyrocket up to an altitude of more than 12 miles and then pushed over for a level speed burst at more than 1,000 miles an hour — faster and higher than anyone had ever flown before — he was too busy with his instruments to look around and see what it was like up there. But he describes his sensation this way: "You feel like you're going right out of the world."

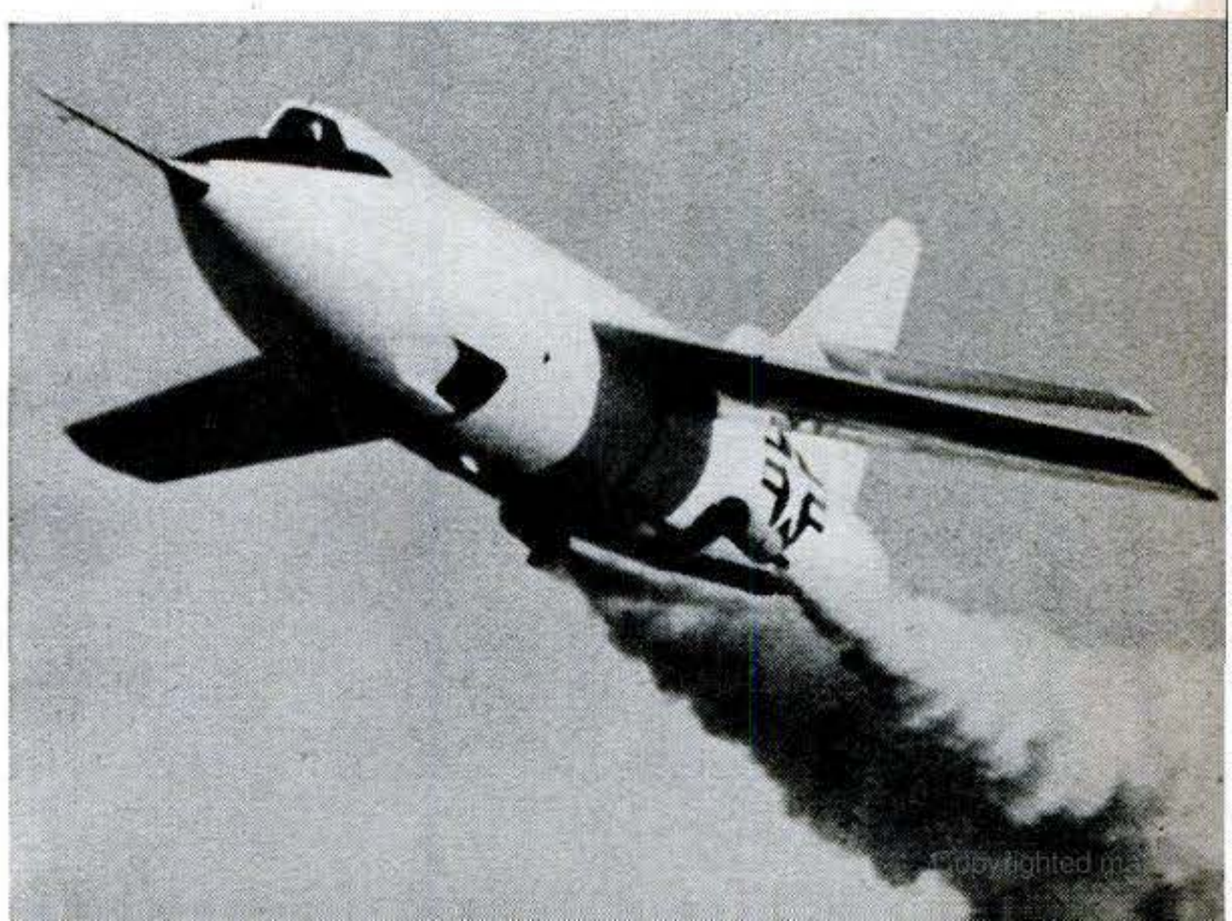
B-29 Launches Rocket Plane

For his record-breaking flight, the Navy D-558-2 Skyrocket was powered by pure rocket thrust. Originally the experimental plane had both jet and rocket power (PS, Jan. '48, p. 135). The present three-ton load of rocket fuel is spent at a rate of a ton a minute, so the craft cannot waste it taking off or landing under its own power. That is why Bridgeman took off from the belly of a B-29 bomber at 35,000 feet, turned on his four flame-spewing rocket engines, climbed to altitude, and made his supersonic speed run. Then, when his fuel was exhausted, he had to glide his 15,000-pound craft down for a landing at Muroc Dry Lake, Calif.

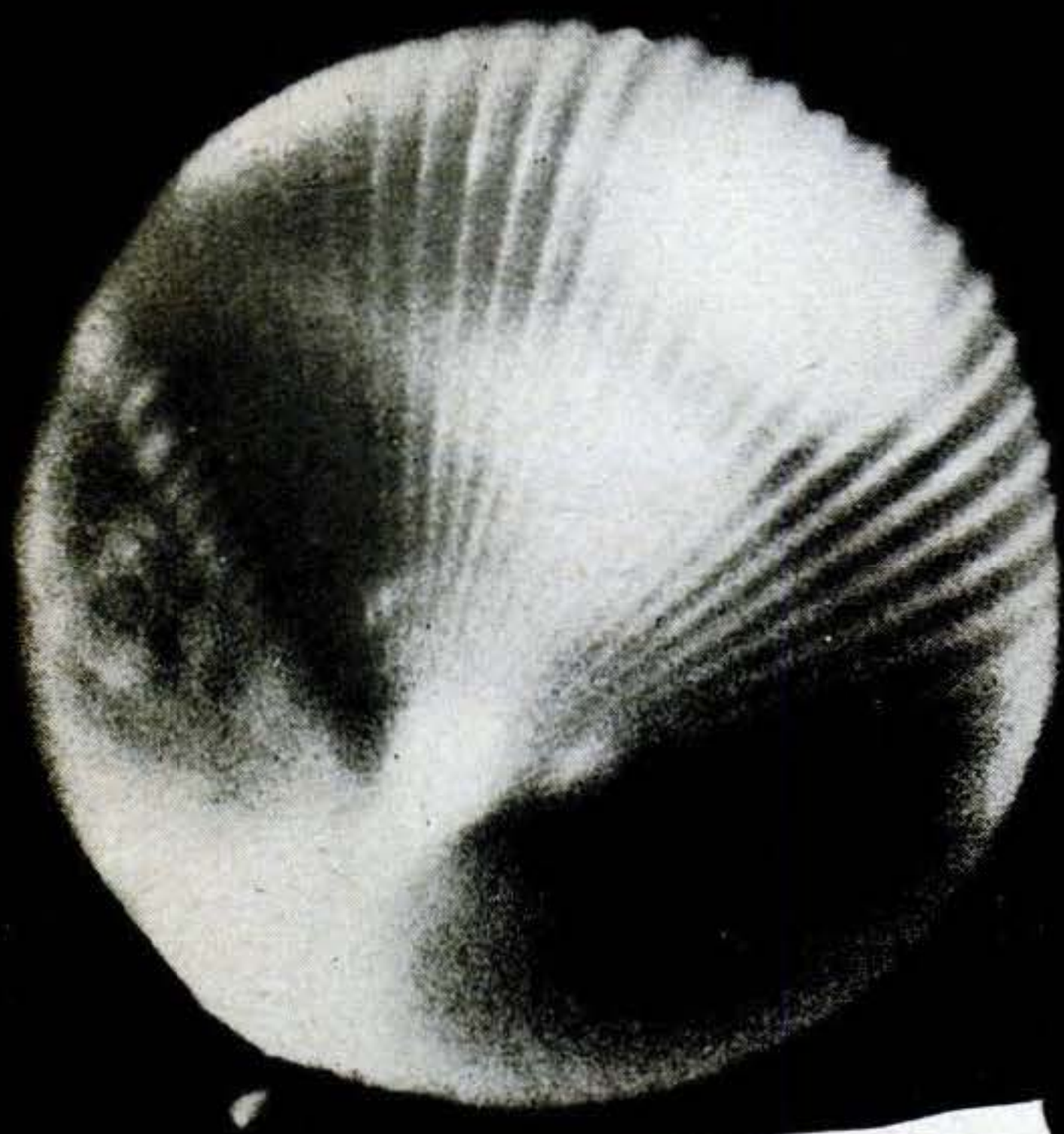
The previous speed record was claimed by the Air Force when the experimental Bell X-1 exceeded the speed of sound by "hundreds of miles an hour." (Speed of sound at sea level is 760 m.p.h., but at the high altitudes these craft fly it is about 660 m.p.h.)

At the altitude Bridgeman pierced, air pressure is so low that without adequate protective covering his blood would have boiled and his body exploded. So, although his cabin was pressurized, he also wore a pressure suit, the details of which are secret, that resembles a deep-sea diver's outfit. The plastic facepiece of his helmet had a tiny windshield wiper to clear condensed breath. END

Skyrocket, shown in jet-assisted flight below, now is powered by four rocket engines alone.



What Were the

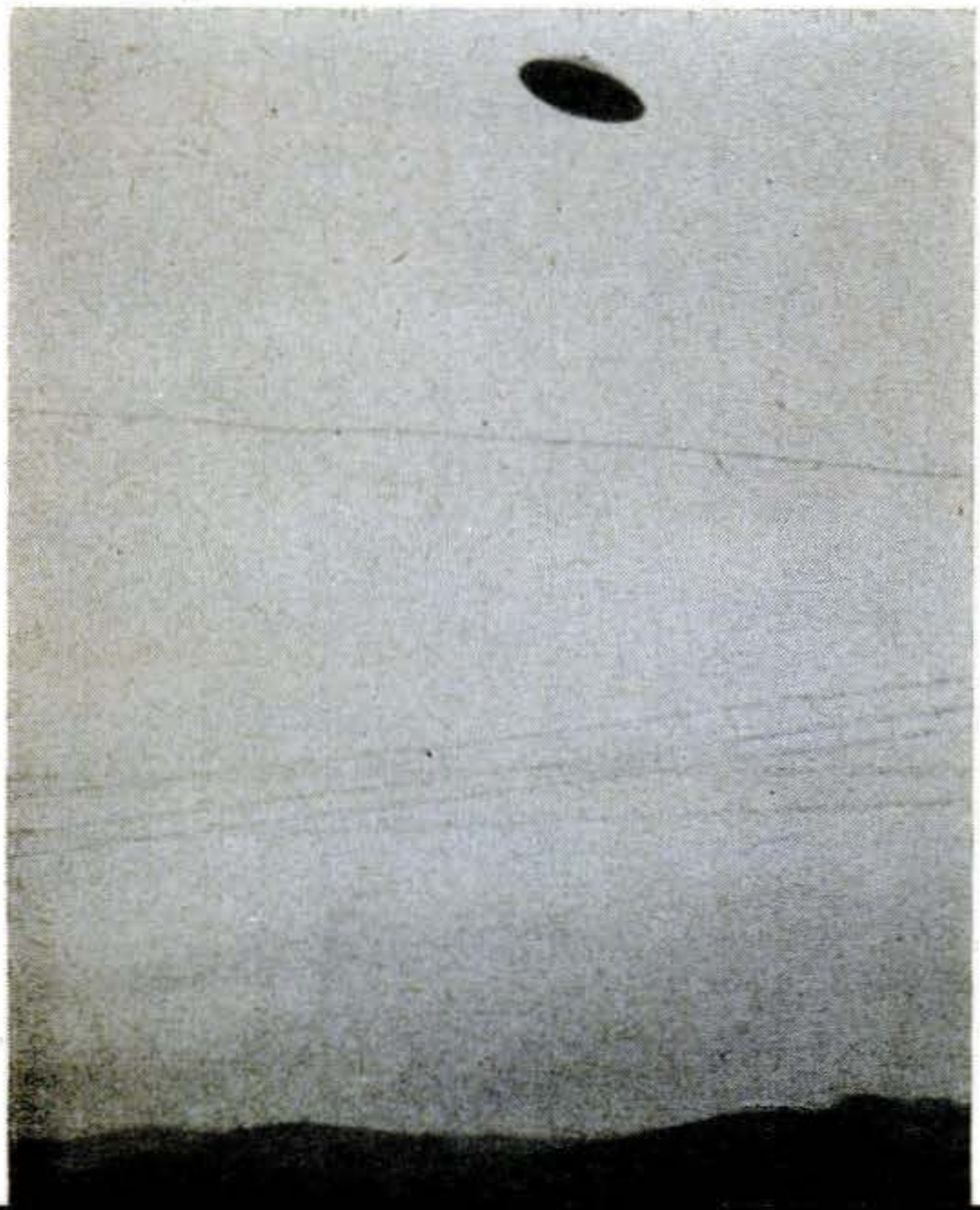


BALLOONS. New kinds of balloons that rise very high and go very far have been used extensively. ?

MAN-MADE AIRCRAFT. These might be new and secret developments of our own or some other country's experimenters. ?

Eyewitnesses Believe They

"Flying saucer" below is clearest photo yet published. Oregon farmer Paul Trent says he snapped it near McMannville. Photos above illustrate four saucer theories. Shown are (l. to r.): huge balloon for high-altitude research; Navy's experimental "flying flapjack"; scene from movie "The Day the Earth Stood Still"; shooting star photographed at Yerkes Observatory.



Polled in a PS survey, the people who actually saw the "saucers" declare overwhelmingly for man-made aircraft.

THE experts can say what they like, but a lot of people who saw "flying saucers" have made up their minds for themselves. And they don't think they saw balloons. Most believe they got a quick look at some secret, radically different airplane.

The eyewitnesses were asked this summer in an unofficial survey conducted by POPULAR SCIENCE editors to choose which of the four explanations illustrated above seemed most plausible to them.

52% believe they saw "man-made aircraft."

16% believe they saw "something commonplace."

4% believe they saw a "visitor from afar."

28% are still uncertain, but more than half of them think they saw either man-made aircraft or visitors from afar.

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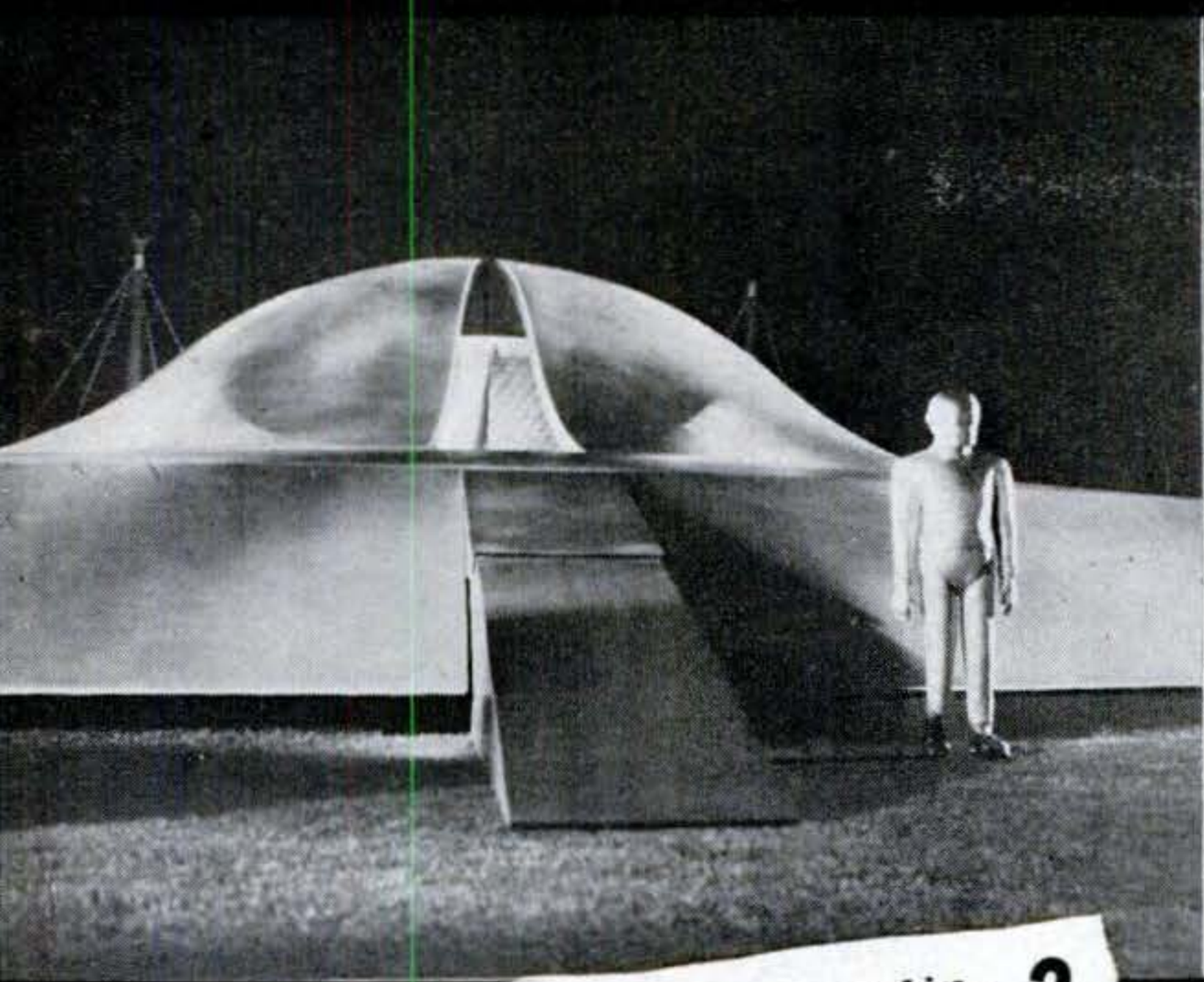
Flying Saucers?



VISITORS FROM AFAR. If there are living creatures elsewhere in the universe, they might have sent these things. ?

SOMETHING COMMONPLACE. "Saucers" might be optical illusions or familiar objects which simply looked unusual. ?

Saw Secret Aircraft

None thought that he'd seen a balloon—not even as a second choice.

The four theories were described in the questionnaire as shown under the photographs above. The choices were made broad enough to cover the theories put forward by all the experts who have explained the saucers to their own satisfaction. To find out whether these explanations were accepted by the only people who have actually *seen* so-called saucers, the editors wrote to all the eye-witnesses whose addresses could be obtained. About 25 percent responded.

Among them were airline pilots, professional men, scientists, businessmen and members of the armed forces. No one reading their replies could fail to be impressed by their sincerity.

Typical of the arguments put forward against the balloon theory was the letter of Coastguardsman Frank L. Ryman, Jr., now stationed in Saint Louis. After explaining how he fixed the altitude of the "saucer" by obtaining, from a nearby Naval air station, the height of two layers of clouds between which it passed, Ryman went on:

"The winds at this altitude were very moderate and from the northwest, directly across the course of the object, precluding any possibility of its being a balloon."

Do Birds Have Optical Illusions?

Policeman Kenneth A. McDowell, of Portland, Ore., declared that the things he saw "were not round, they traveled at too great a speed, and were more maneuverable than a balloon could be."

As for optical illusion, McDowell pointed out that his attention was first drawn to the objects by pigeons in a park, who stopped eating and looked up. "Would birds be subject to optical illusions?" he asked.

On the other hand, a Canadian reported his opinion that it was "an ordinary aeroplane at a distance flying toward a setting sun in our case."

[*Continued on page 228*]

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TWIN UNLOADING TOWERS TRAVEL ALONG PIER ON MOTOR-DRIVEN WHEELS

BUCKET HOIST TRAVELS ON OVERHEAD TROLLEY

40,000-TON SEAGOING CARRIERS CAN USE 650-FOOT PIER

HATCH COVERS OPENED FOR UNLOADING

15-TON BUCKET TRANSFERS ORE FROM SHIP TO CONVEYOR BELT EXTENDING ALONG PIER

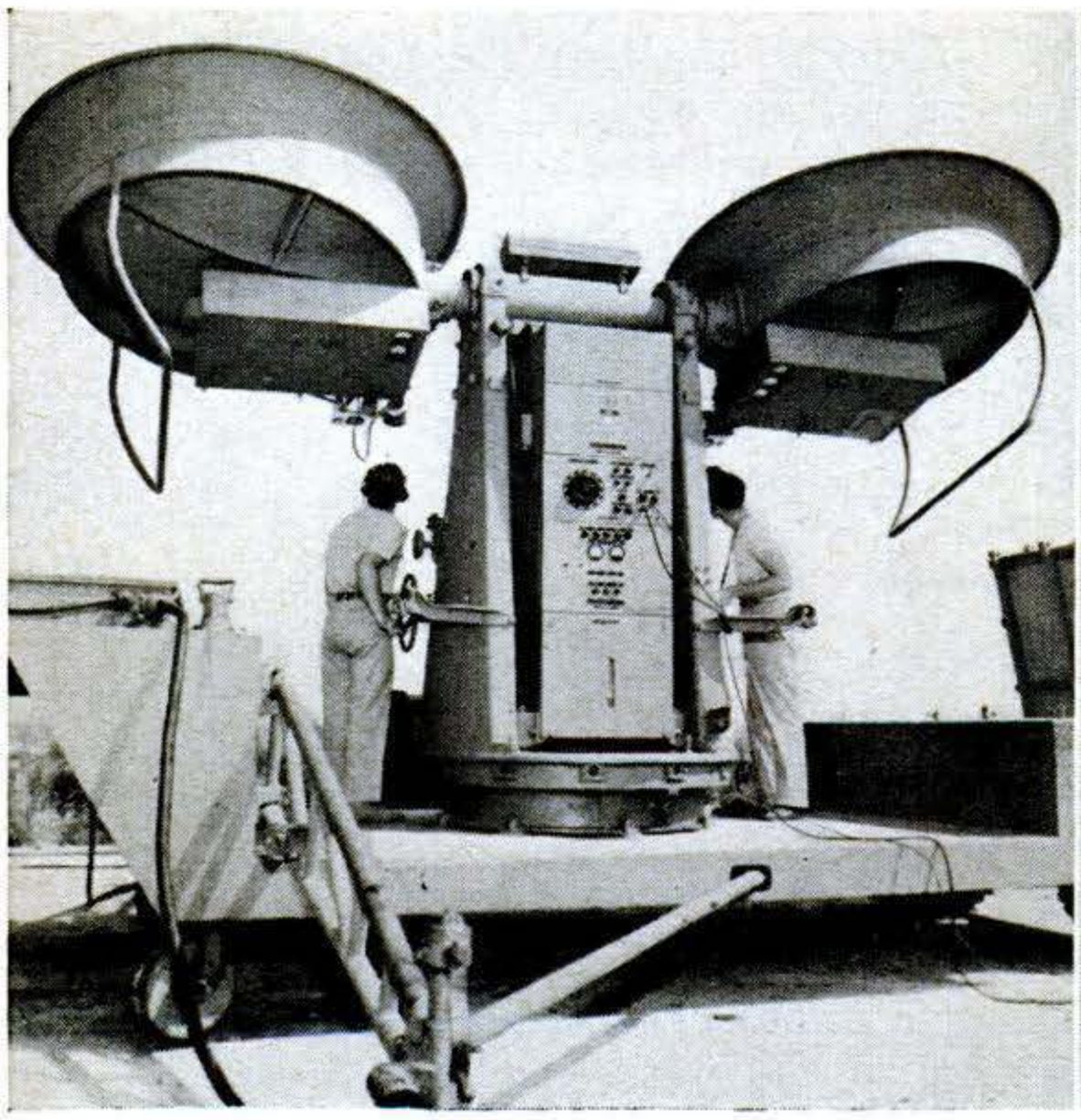
Iron Ore Flies from Ships to Trains at This New Pier

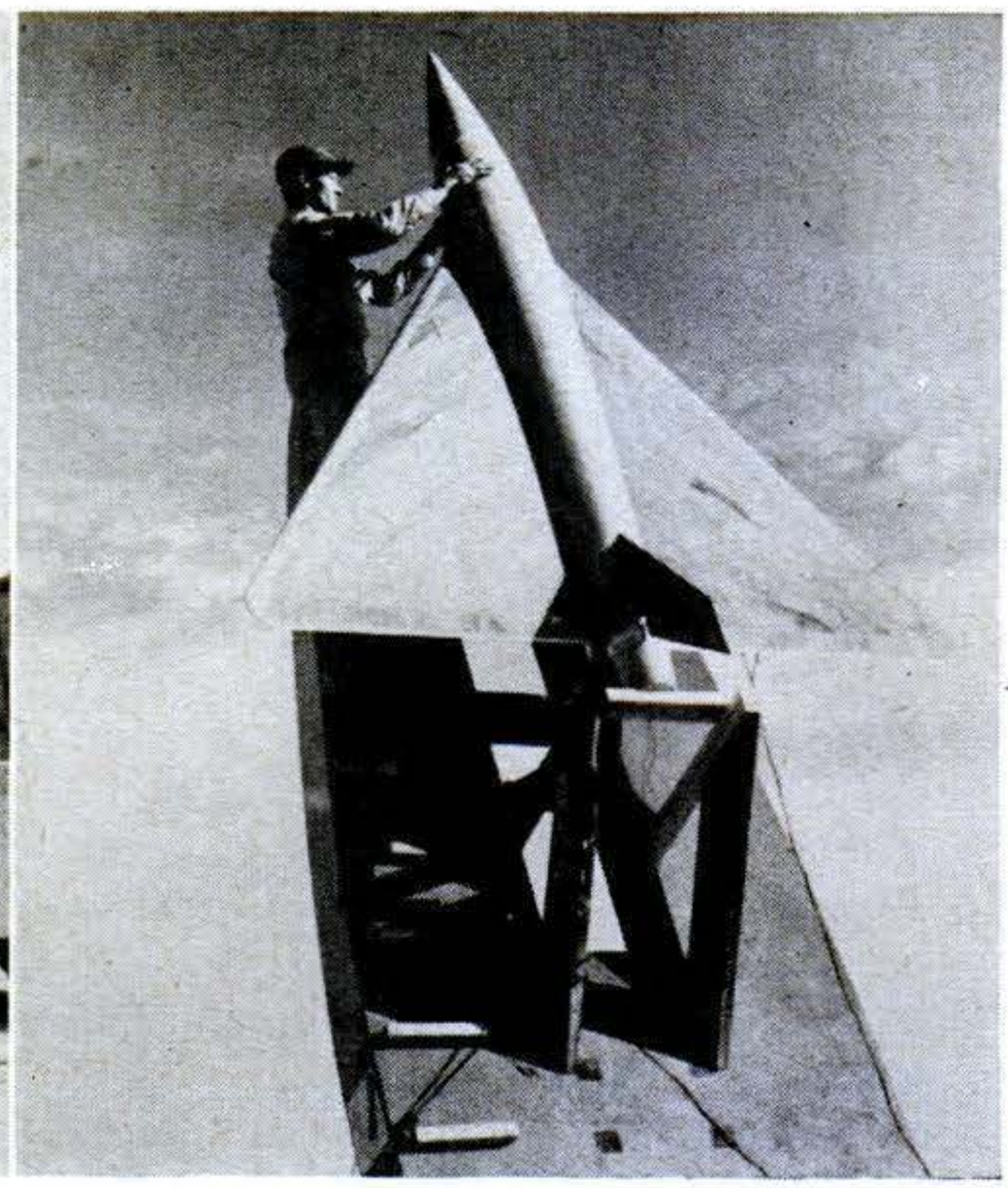
THIS new $5,000,000 pier at Baltimore, Md., unloads the largest ore-carrying ships in less than 24 hours. It was designed to handle iron, chromium, and manganese, imported from Venezuela, Liberia, and other faraway lands to supplement dwindling domestic supplies.

Giant machines whisk the ore from holds of ocean vessels into strings of waiting rail-

Radar Clocks Rocket's Speed

THE twin saucers below keep such close tabs on the model rocket plane at right that researchers won't even care when the model speeds out to sea and is lost. They'll have a permanent record of its flight. The saucers are radar transmitting and receiving antennas that clock the model as it shoots out at 900 to 2,400 m.p.h. In use at Wallops Island, Va., the apparatus measures speed by the change in frequency of the return wave—the Doppler effect.





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RUBBER-BELT CONVEYOR, 895 FT. LONG AND 4 FT. WIDE, CARRIES ORE FROM PIER TO RAILROAD

SCALE HOUSE DELIVERS AUTOMATICALLY WEIGHED LOADS OF ORE TO R.R. HOPPER CARS AS THEY ARE MOVED ALONG LOADING TRACKS BENEATH IT

LOADED CARS ARE MADE UP INTO OUTBOUND ORE TRAINS. CARGO OF 30,000-TON SHIP REQUIRES EIGHT TRAINS TOTALING 500 CARS

road hopper cars at the rate of 2,000 tons an hour.

Operated by the Baltimore and Ohio Railroad, the 650-foot ore-handling pier is the first of its kind in the East. Two unloading buckets on traveling towers, and a rubber-belt conveyor, unload ships as big as 40,000 tons. The pier's design will permit extending it another 600 feet and erecting two more unloading towers on it, to accommodate two ships at a time, if the demand for imported ores increases in the future.

Hoist Extends Pruners' Reach

A HYDRAULIC hoist from a filling-station grease rack has gone to work pruning apple trees in a Kinderhook, N. Y., orchard. Mounted on a harvesting trailer, the hoist has a platform on top with "diving-board" extensions to let workers reach way out. Hydraulic power from a tractor raises the platform to a height of 13½ feet.

Atom Plant Grows "Hot" Fish

COULD you get sick by eating fish from radioactive waters? To find out, the Hanford plutonium plant raises salmon in tanks of water more radioactive than the atomic-pile cooling water discharged into the Columbia River. Tests show you'd have to eat, at one sitting, 100 pounds of the "hot" fish to take in appreciable radioactivity.

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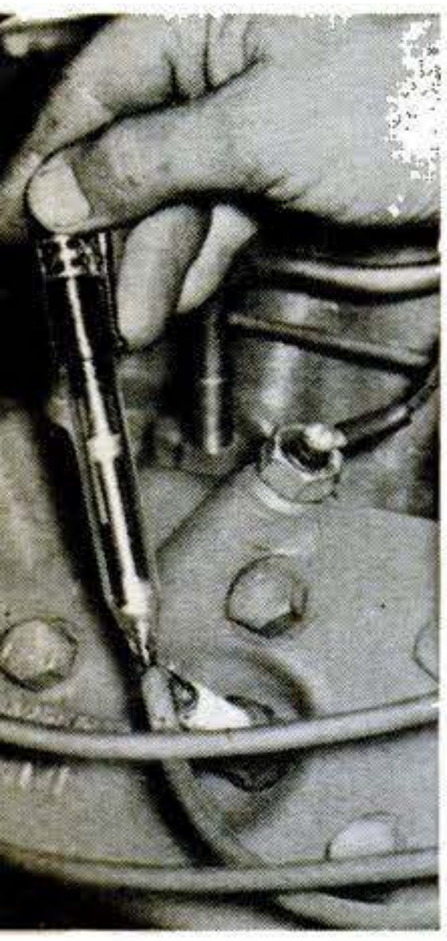
Ruining Uniforms Is Their Job

CROSSING the Army's roughest obstacle courses is the everyday job of these GIs—not for training, but to test new uniforms. In the photo above they are giving experimental black-and-white fatigues a drastic abrasion trial by crawling over sharp stones. Five courses, including two designed specifically to try out shoes and gloves, are used. The soldiers may clamber through cement pipes, barbed wire, and gullies before the Quartermaster Board okays an item of apparel.



Flasher Checks Spark Plugs

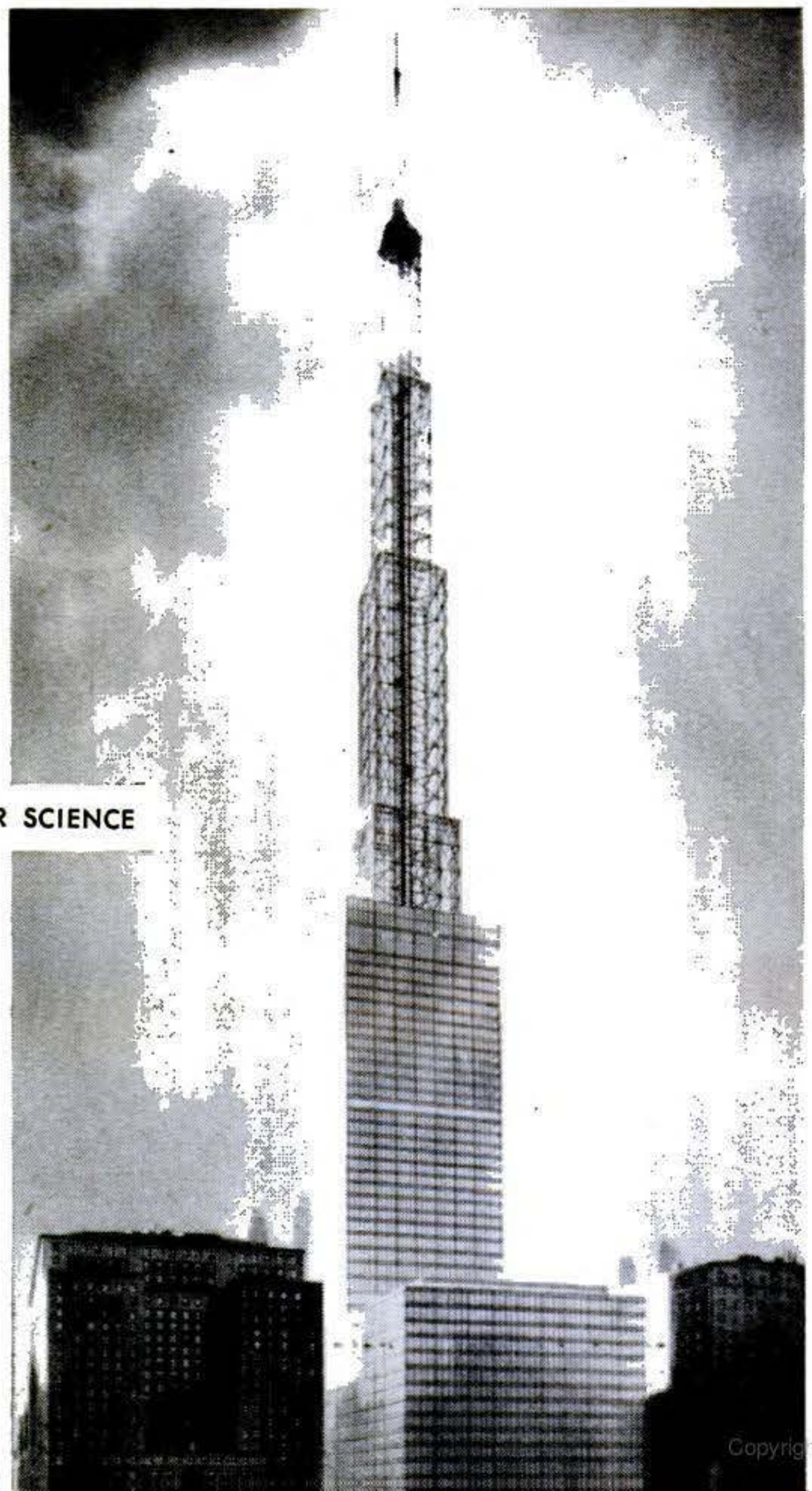
TESTING a spark plug with an old screwdriver may be fast, but it isn't always accurate—and it can lead to some nasty shocks. This tester at left avoids those troubles. It flashes each time the plug fires—brightly if everything's okay, weakly if the plug is fouled, unevenly if something is wrong with coil, breaker points, or cable connections. It's made by the Champion Spark Plug Co., Toledo.

Plastic Playhouse Hangs from Line

BIG enough for a whole troop of kids, this Vinylite plastic playhouse is set up by simply hanging it from a stretched clothesline. The house is 8 ft. long, 5½ ft. high and 4 ft. wide. Wooden slats inside keep the roof spread, while loose sides allow plenty of air for ventilation. Doughboy Industries, Inc., New Richmond, Wis., makes it.

New Skyscraper May Top Empire State

THE famous Empire State Building, for 20 years the world's tallest, may be outstretched 108 feet by a new structure piercing the clouds 1,580 feet above New York's streets. The new building planned by Webb and Knapp, Inc., is to have 44 stories of office space—the rest would be a 1,000-foot open-steelwork observation tower and TV mast.



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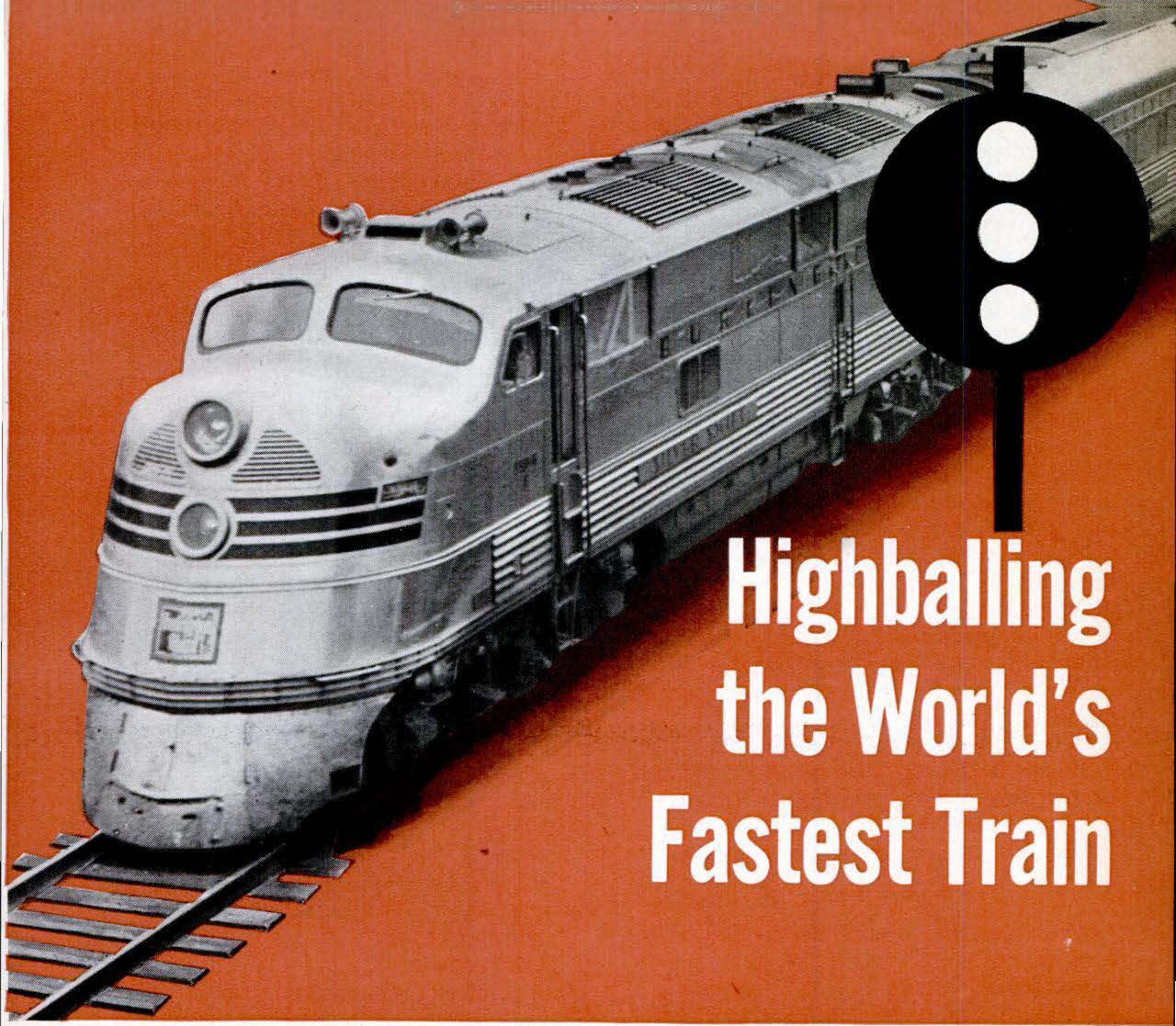

Highballing the World's Fastest Train

Speediest scheduled run hits over 86 m.p.h. on one stretch, averages 70 between Chicago and the Twin Cities.

By Devon Francis

WE WERE exactly one hour and 15 minutes out of Chicago, doing 90 miles an hour, when the shower of feathers whipped up past the double windshields of the locomotive of the Twin Cities Zephyr.

It was startling. I ducked. Bob Glaser, road foreman of engines, who was standing beside me on the swaying floor, grinned.

"Hit a pigeon," he explained, raising his voice to carry above the low thunder of the Diesel engines. "Hit 'em often. Turtle doves are the slowest getting out of the way. We hit pheasants too, but hardly ever a crow. Crows are smart."

I had come along to ride the Zephyr's "head end" for 299 of its 427 miles to St. Paul. I was on the world's fastest train. Of the 686 fast trains in the United States, only 32 of them maintain a speed of 75 miles an hour or more between any two cities on their routes. Only three do better than 80—the Burlington railroad's northbound Zephyrs, departing morning and afternoon, and the Illinois Central's City of New Orleans.

4,000 Horses in a Hurry

The Zephyrs cover the 55 miles between East Dubuque, Ill., and Prairie du Chien, Wis., at a speed of about 85 miles an hour. They average almost 70 miles an hour, including stops, on their two round trips a day between Chicago and St. Paul. No trains in Canada or Europe can compare with their speed.

It had been 8:06 by my watch when I

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walked through the gate of Chicago's Union Station and into the perpetual dusk of the train shed. The Zephyr had seven cars. Their ribbed, stainless-steel sides were silver in the twilight.

Cab is Clean and Spacious

The cab of the Diesel-electric locomotive was meticulously clean. It was almost 10 feet wide and perhaps six feet deep at its narrowest point. An upholstered chair was on either side, the left one for the fireman, the right for the engineer.

The locomotive actually consisted of two locomotives linked together. Each unit contained two 1,000-horsepower Diesels driving generators to supply DC power to traction motors that propelled the train.

The engineer was W. J. Reinhard, the fireman P. E. Johnson. Road-foreman Glaser occupied the back of the cab with me.

The engineer hung his watch on his instrument panel. I leaned over and reset mine.

"Pretty close," said Engineer Reinhard of his watch, "10 seconds fast, is all."

Behind us the engines muttered.

It was 8:15. An air whistle in the cab beeped twice—the proceed signal.

"Straight up," called the fireman.

"Straight up," repeated the engineer.

The Zephyr Takes Off

Ahead on the ground beside the track, vertical white lights gave us clearance to move. The fireman's call and the response were regulation, so that each member of the crew will know that the other has observed the signals correctly.

"Clear," called the fireman.

"Clear."

Engineer Reinhard brought his throttle back. The engines whined. The noise was guttural, low-pitched. It filled the cab. Almost 900 tons of train began inching forward.

Slowly we gained speed.

The speedometers read 25 miles an hour, then 35. The cab swayed as the trucks took the crossovers in the complex of tracks in the yard. In another minute we were doing 55.

"High green!" sang Fireman Johnson.

"High green!"

A signal bridge ahead carried a green light above a red one for our track, indicating track clear ahead.

75 Seemed Like 40

At Cicero, seven miles out, the engineer waved at a man in an interlocking plant tower beside the track. We were doing 75 now. It seemed like 40. Sitting high in the cab above the track did that to your judgment of speed.

At 8:36 we whipped by Donners Grove, 21 miles out. We had averaged 60 miles an hour.

"Yellow!"

"Yellow!"

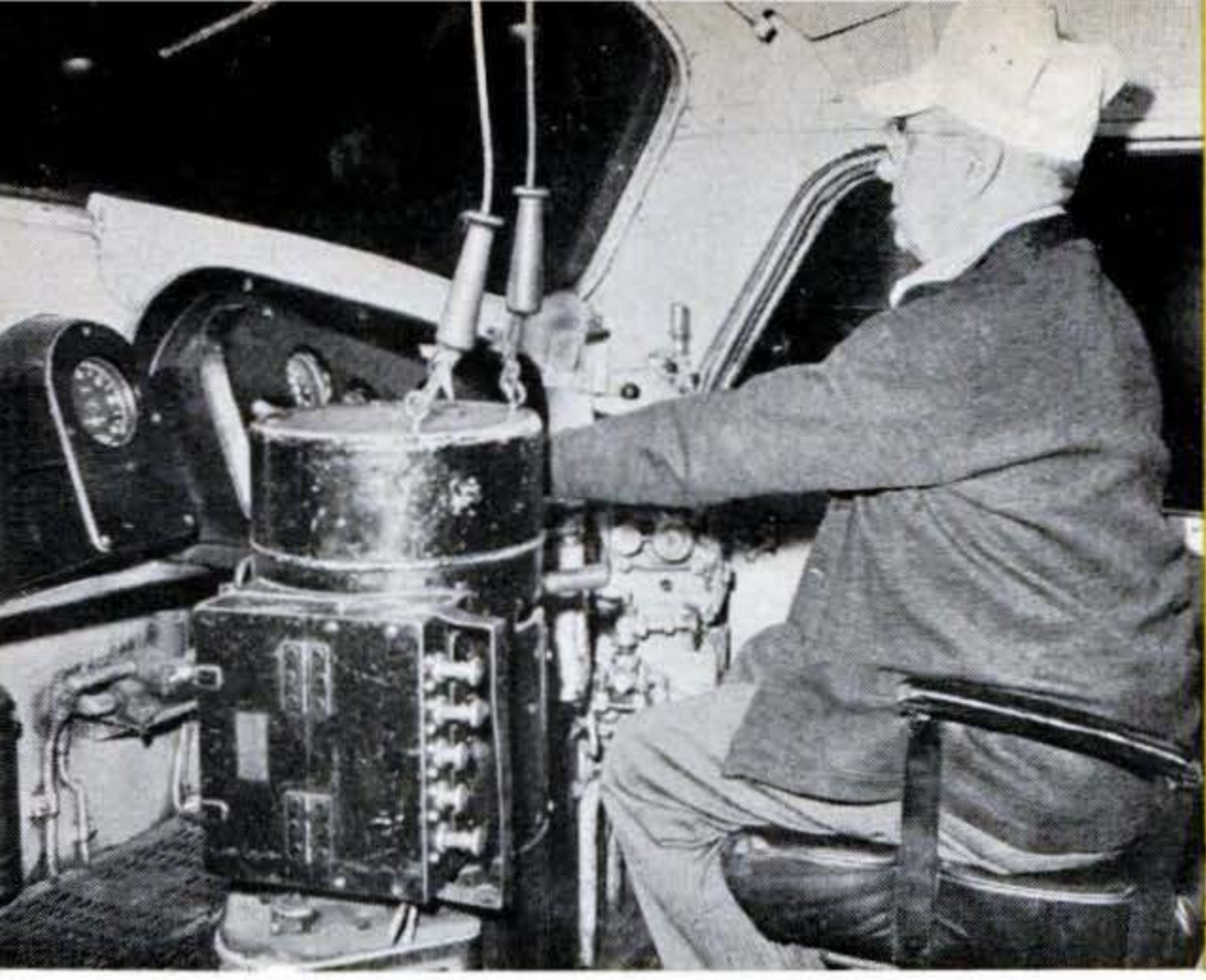
This was a caution light. We were to be governed by the next signal ahead.

"Yellow crossover!"

"Yellow crossover!"

The engineer closed his throttle. The tower at Aurora gave us a flag stop. We coasted in. In less than a minute we were on our way again. The air hissed and sighed

Zephyrs feature Vista Domes atop cars for sightseeing. General Motors 12-cylinder Diesels have 8½-in. bore, 10-in. stroke, and are capable of driving train 117 m.p.h.



Engineer W. J. Reinhard demonstrates armchair ease of piloting Zephyr. His left hand is on throttle. Engines carry 1,200 gallons of fuel, 330 gallons of oil and 400 gallons of water.

as the brakes were released. The engineer pulled on his throttle.

Now we were on the Aurora-Savanna subdivision, single-tracked, and under Centralized Traffic Control. The dispatcher in Aurora could shunt us off on to any siding under his jurisdiction with remote, power-operated switches.

At 8:58 the speedometer needle stood at 85. Then it touched 90 and clung there. The locomotive wrenched at the track. Reinhard tugged at his horn cord for a grade crossing—two longs, a short and a long.

A zone-speed board with a 4 and a 5 painted below the Z told us to reduce speed to 45 miles an hour. The engineer pulled a lever that set a warning bell ringing. Then we were out of the zone and at 90 again.

Presently a C sign with 60 below it told us to slow to 60 for a curve.

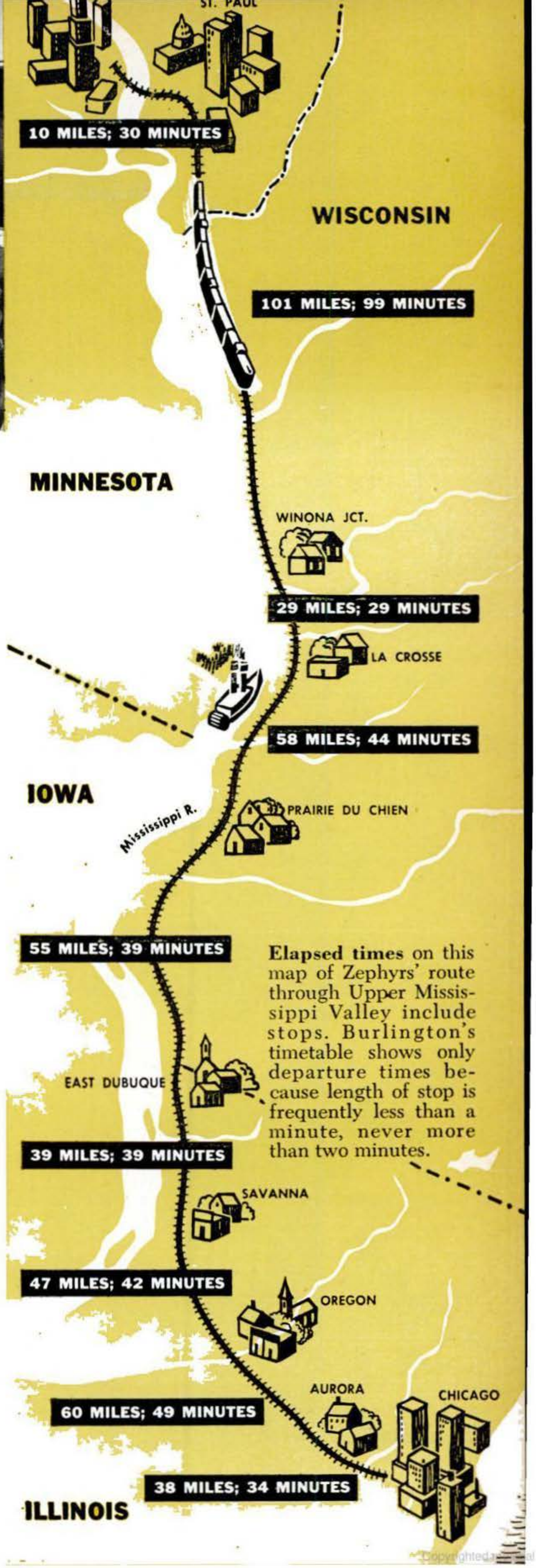
The engineer pulled his cord for one long blast. That was the station signal.

At 9:37½ we braked to a stop at Oregon, Ill. In a half-minute the engines were whining again. I timed the acceleration. It took us nine minutes to reach 90. We were scheduled into Savanna, where we changed crews, at 10:20. We rolled in at 10:19. We had averaged better than 70 miles an hour from Chicago for the 145 miles.

New Crew Takes Over

A big, ruddy-faced man with a booming voice, Jack Kerrigan, settled himself in the cab's righthand seat. The new fireman was

[Continued on page 230]

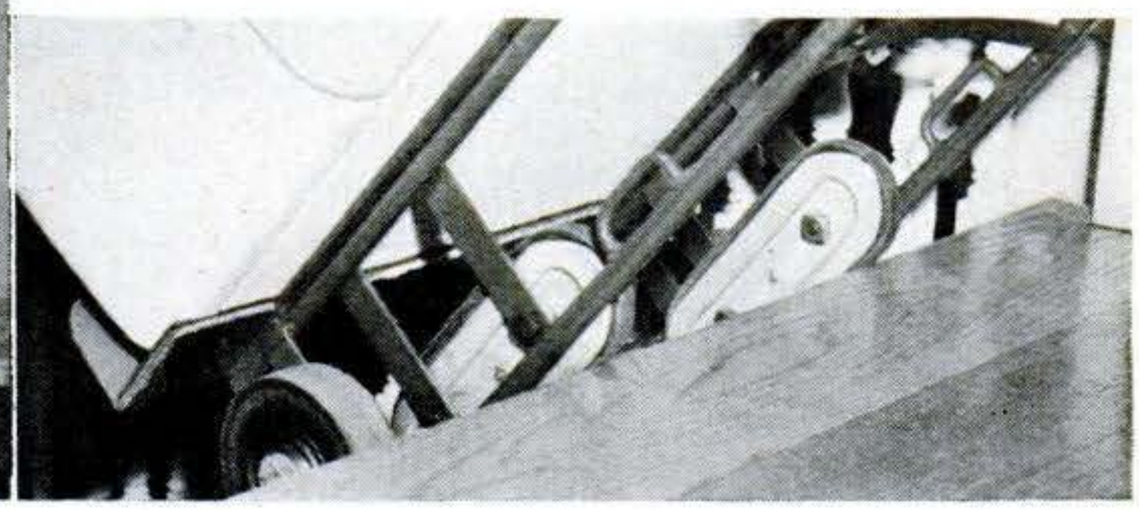


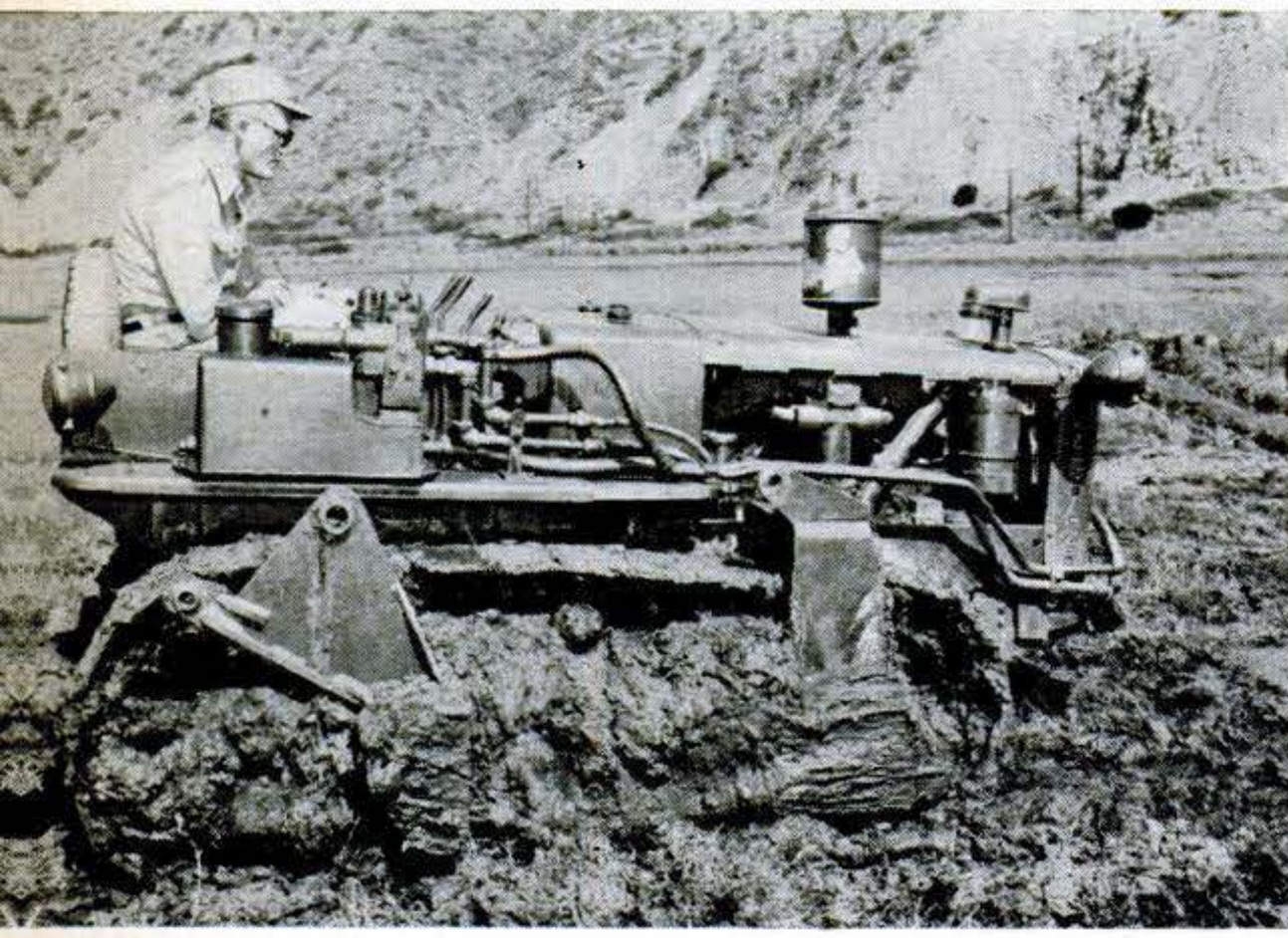
Elapsed times on this map of Zephyrs' route through Upper Mississippi Valley include stops. Burlington's timetable shows only departure times because length of stop is frequently less than a minute, never more than two minutes.

WHEELS:
Man's Oldest Machine Learns New Tricks

Handtruck Crawls Up Steps

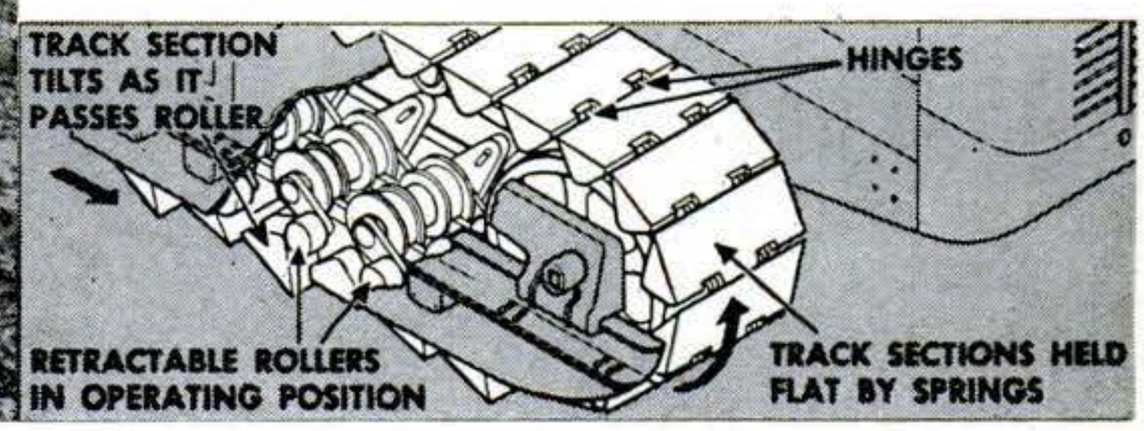
You can whisk a refrigerator upstairs on this handtruck without resorting to jujitsu. Miniature crawler treads of rubber belting on roller bearings (below) take steps in their stride—supplementing standard wheels for flat surfaces. The Fairbanks Co., Rome, Ga., makes the truck.





Navy Tractor Claws Through Mud

RETRACTABLE "toes" help the tractor at left get a grip on slippery mud. The Navy's all-purpose tread has hinged sections that dig into the earth when rollers tilt them intermittently (diagram). On highways the rollers are retracted and rubber springs hold the track sections flat.



Ambulance Bus Rides Rails

ARMY ambulance busses like the one at left can ride railway tracks instead of roads, carrying wounded soldiers faster and more comfortably from front lines to hospitals. Auxiliary flanged wheels for rail travel (left) are retracted with a hand crank (below) when bus takes to highway.

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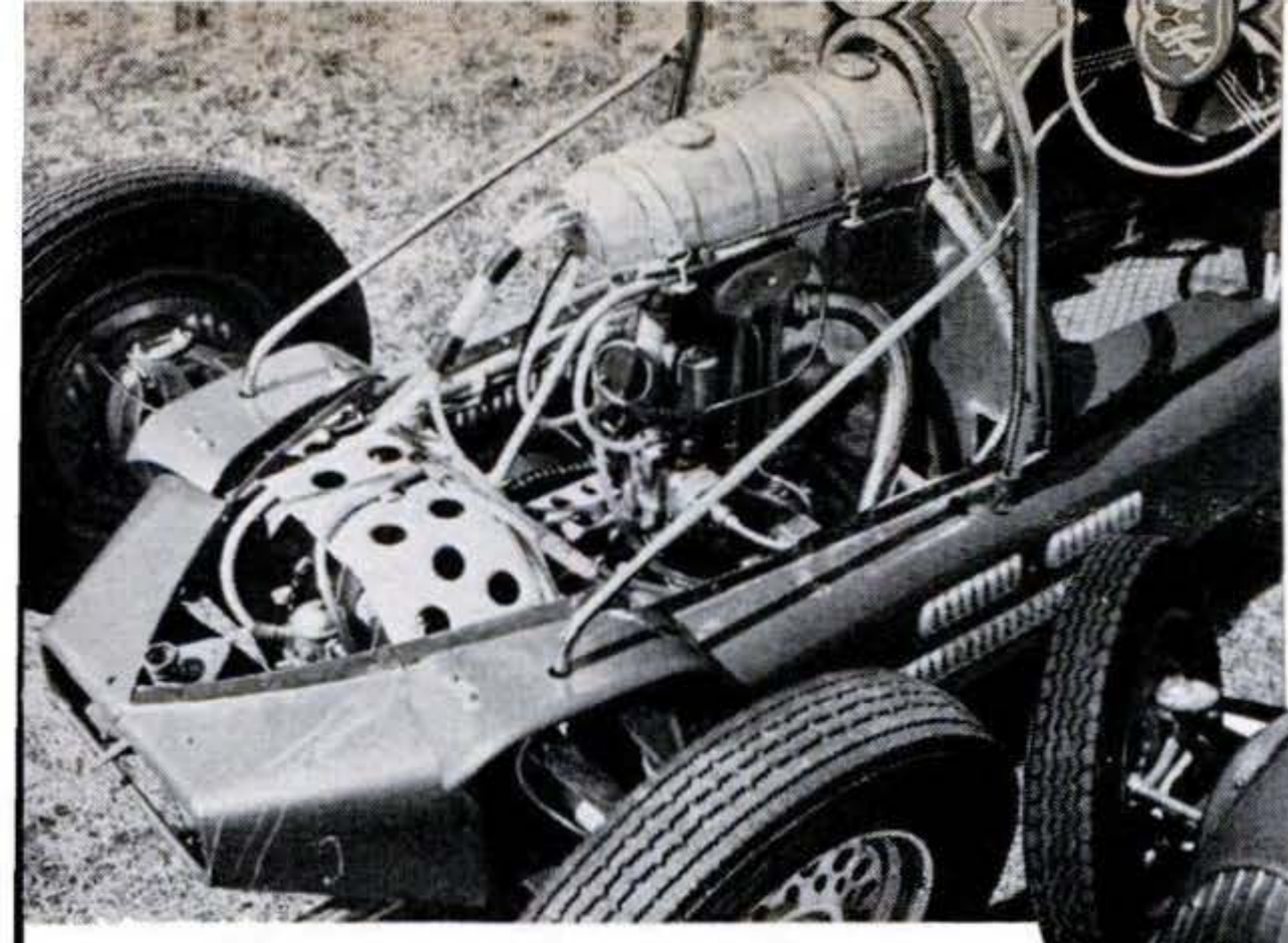
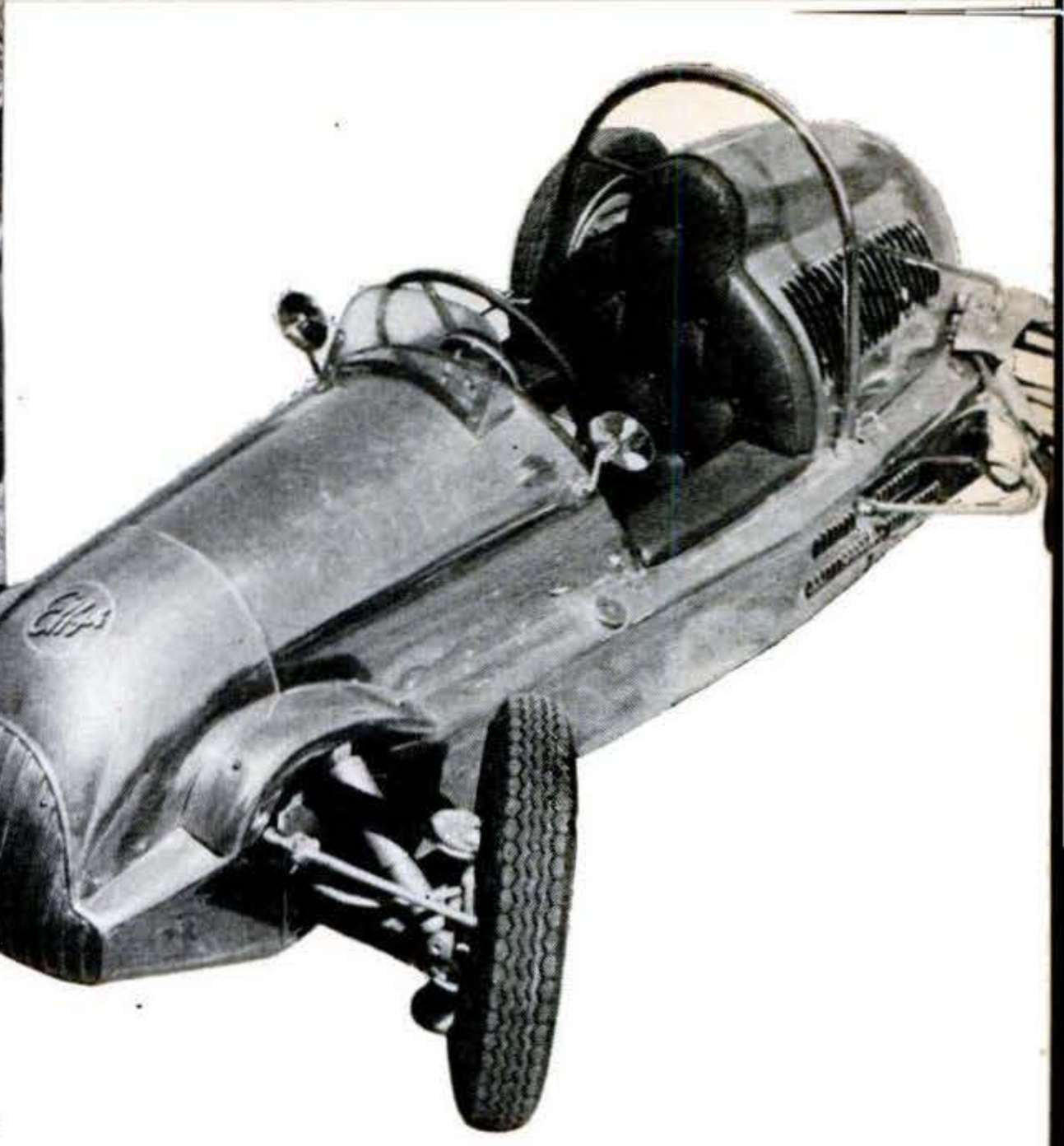


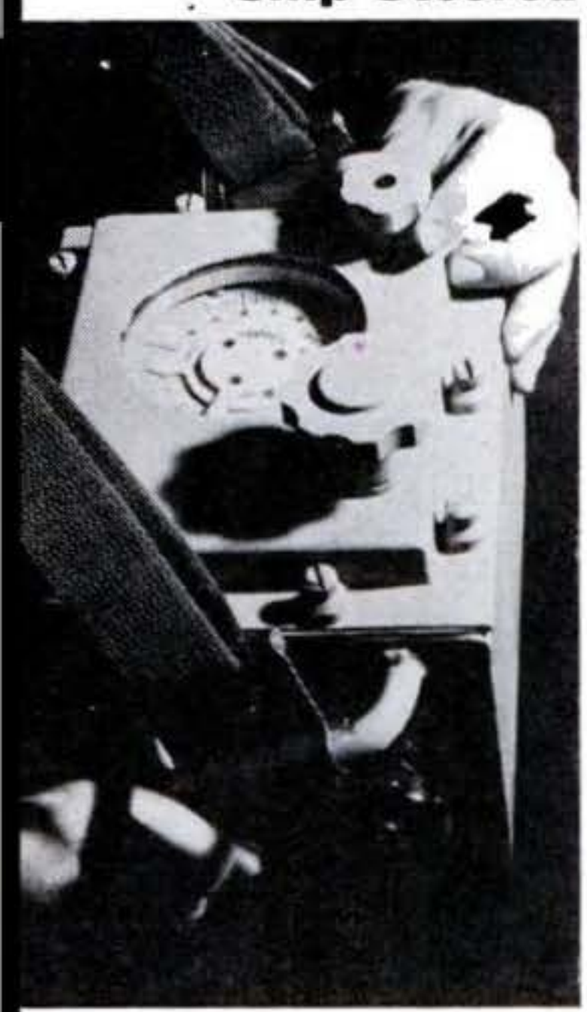


Rear-mounted engine eliminates heavy drive shaft and also enables the driver to sit practically on the ground. It burns methyl-alcohol fuel and gives 8½ miles to the gallon.

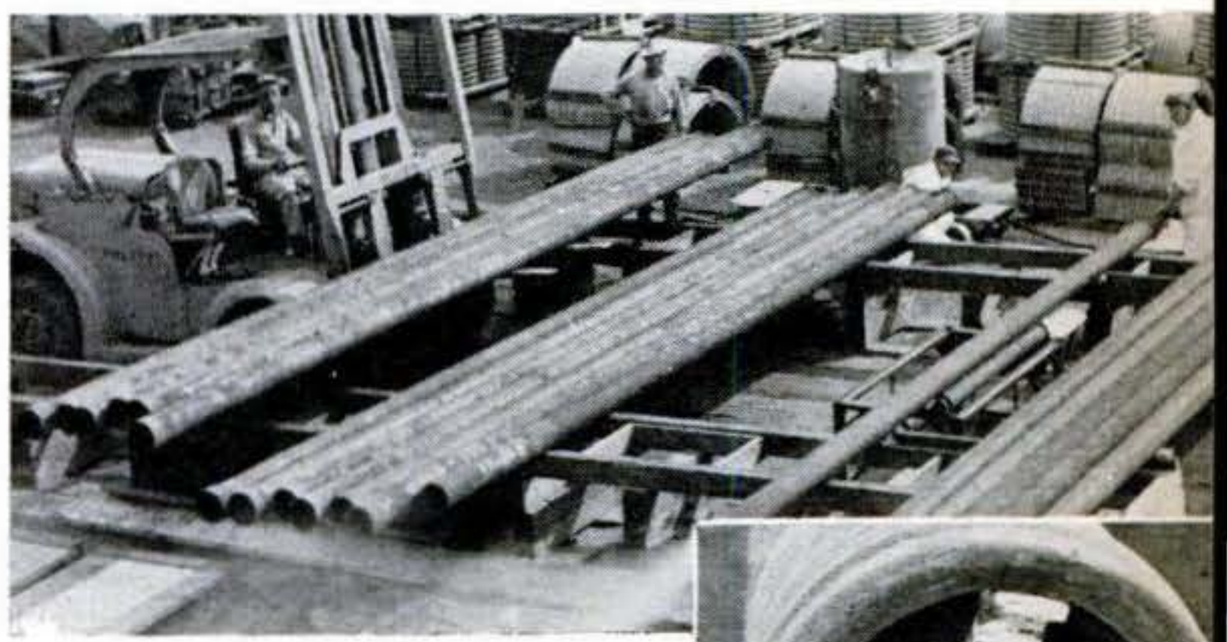
Midget Hits 100 M.P.H. in 15 Seconds

COMBINE two Swedish aeronautical engineers and a British J.A.P. motorcycle engine and the result is a midget road racer that could shoot away from stop lights—it accelerates to 100 m.p.h. in 15 seconds. The Hakansson brothers designed the EFFYH, which has a top speed of 125 m.p.h. The rear-mounted engine has a 14-to-1 compression ratio and a displacement of 500 c.c. (30.5 cubic inches). It delivers 43 brake horsepower at 6,000 r.p.m. Grand Prix Motors, Lynbrook, N. Y., distributes it.

Ship Steered by Remote Control

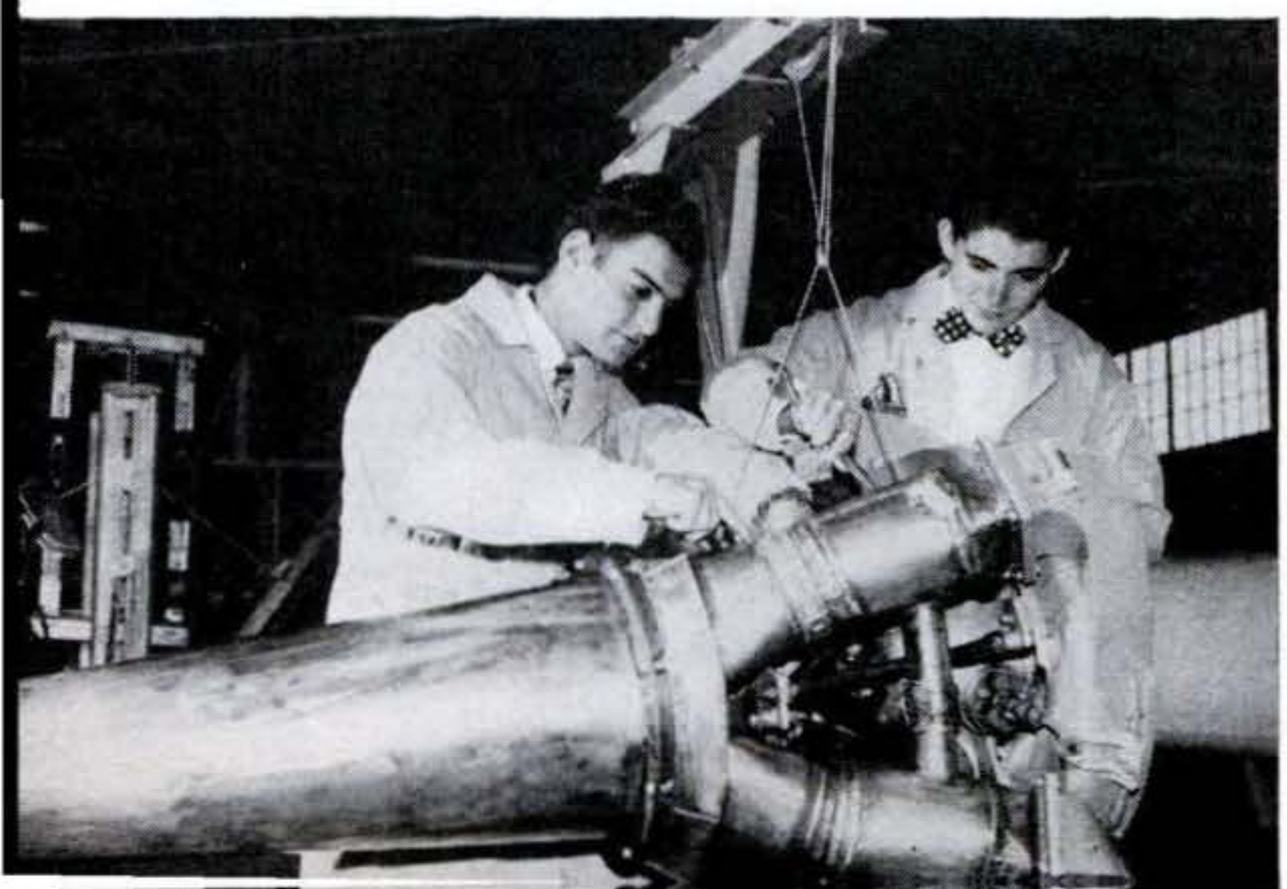


A PLUG-IN device that can steer a ship from almost any place aboard her is being tested for emergency use by the Navy. Should enemy fire knock out the regular wheelhouse, this electric helmsman (left) is simply plugged into one of many scattered outlets that connect to the main power steering unit controlling the rudder. Turning the knob at the top of the device does the actual steering. It was developed by General Electric.



Sandblast Cleans Pipe for Navy

RUST and dirt don't last long inside a length of pipe when it's blasted with triple jets of sand from the compressed-air nozzle shown in the inset. The nozzle rides through the pipe on a three-pronged carriage developed by the Navy.



Junior Jet Built by Students

THE jet power plant at left started as a surplus supercharger from a wartime P-38 fighter. Rebuilt as a classroom project at Northrop Aeronautical Institute, Hawthorne, Calif., it develops 320 pounds of thrust, enough to fly a four-place lightplane.

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Dart-Shaped Plane Sweeps Its Wings Back in Flight

AN AIRPLANE builder finally has succeeded in designing a type of wing that fliers have wanted for 10 years—one that can be swept back in actual flight.

The wings make roughly a right angle with the fuselage when the plane is taking off, climbing or landing. In flight, the wings swing back—the tips much farther than the roots—until it resembles a dart.

There's a good reason: in the forward position, the wings have more lift. The plane can fly more slowly. Moved backward, the wings don't have as much lift, but they can fly much faster. That's because a "swept" wing can go much faster than a straight wing before it develops a retarding "shock wave."

Gas Turbine Supplies the Power

The airplane with the movable wing is the X-5, an experimental plane purchased by the Air Force for research work by the government's National Advisory Committee for Aeronautics. It was designed and manufactured by the Bell Aircraft Corp., of Niagara Falls, the same company that made the X-1, the first U. S. supersonic plane.

Obviously designed for high speeds, the X-5 has a gas-turbine engine instead of the rocket engine that powered the X-1. And, unlike the X-1, it doesn't have to be launched by a mother plane. It can take off from the ground under its own power.

The heart of the X-5 is an electric mechanism, highly secret, that moves the wings forward and backward. Bell had to solve a problem there—as the wings were moved, the plane's center of gravity shifted, and that had to be compensated for.

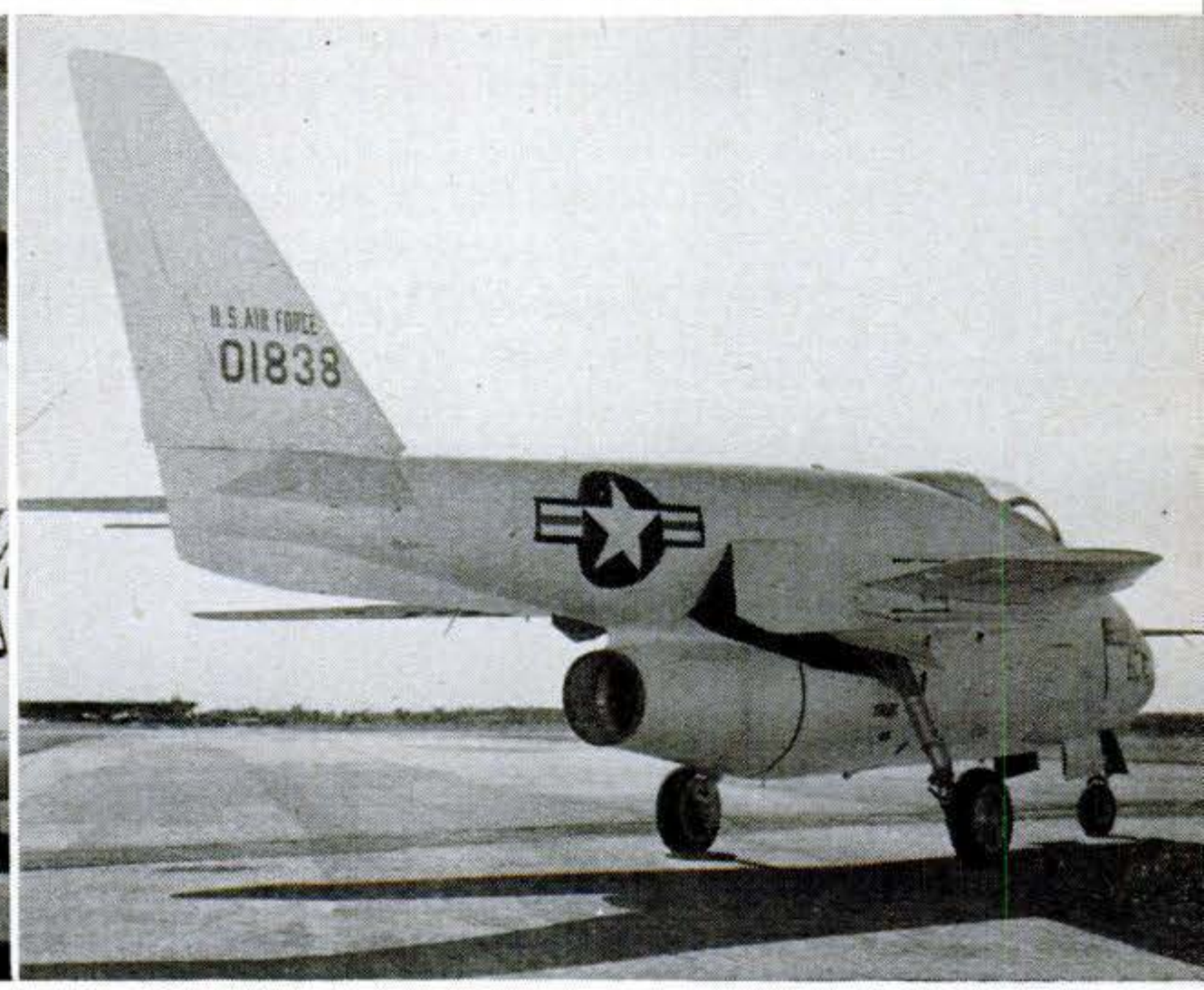
One More Wing Style Wanted

Preliminary flight tests of the new plane are being conducted at Edwards Air Force Base in California by Jean L. "Skip" Ziegler, Bell's chief of flight research.

With the creation of the movable-sweep wing, two-thirds of aviation's ambitions in movable-wing design have been realized. In the XB-51, the Glenn L. Martin Co. produced the first variable-incidence wing. Its "angle of attack" can be changed in flight. Now airmen would like to have a wing that could be lengthened and shortened in flight.

Lines under cockpit are slots that guide wing as it is moved forward and backward. Plane is 33 ft. 4 in. long, has a maximum span of 32 ft. 9 in., weighs about 5 tons.

Back of wing root folds into fuselage. Allison engine is under pilot instead of behind him as in most single-jet planes. Fuselage doors accommodate retractable main landing gear.



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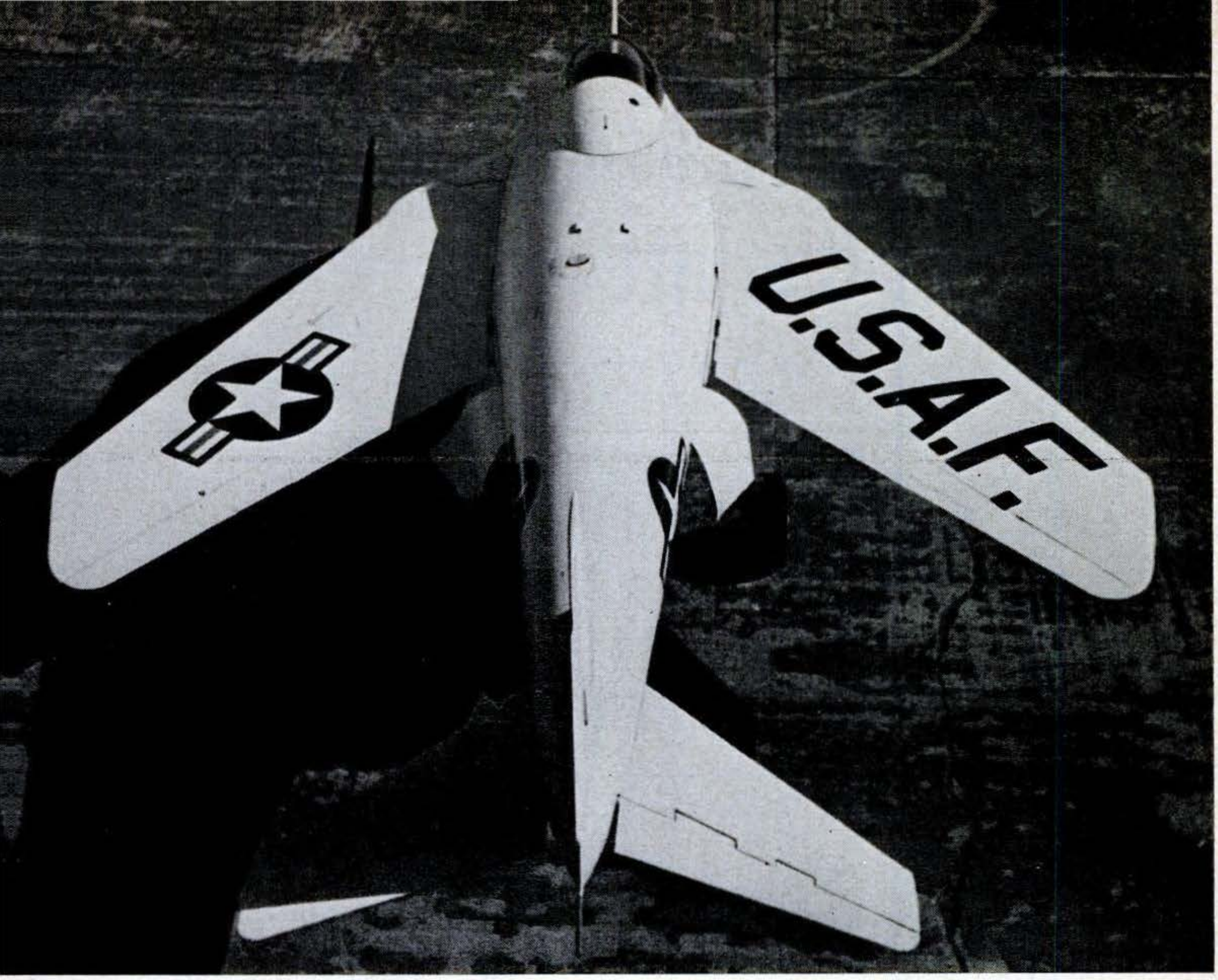
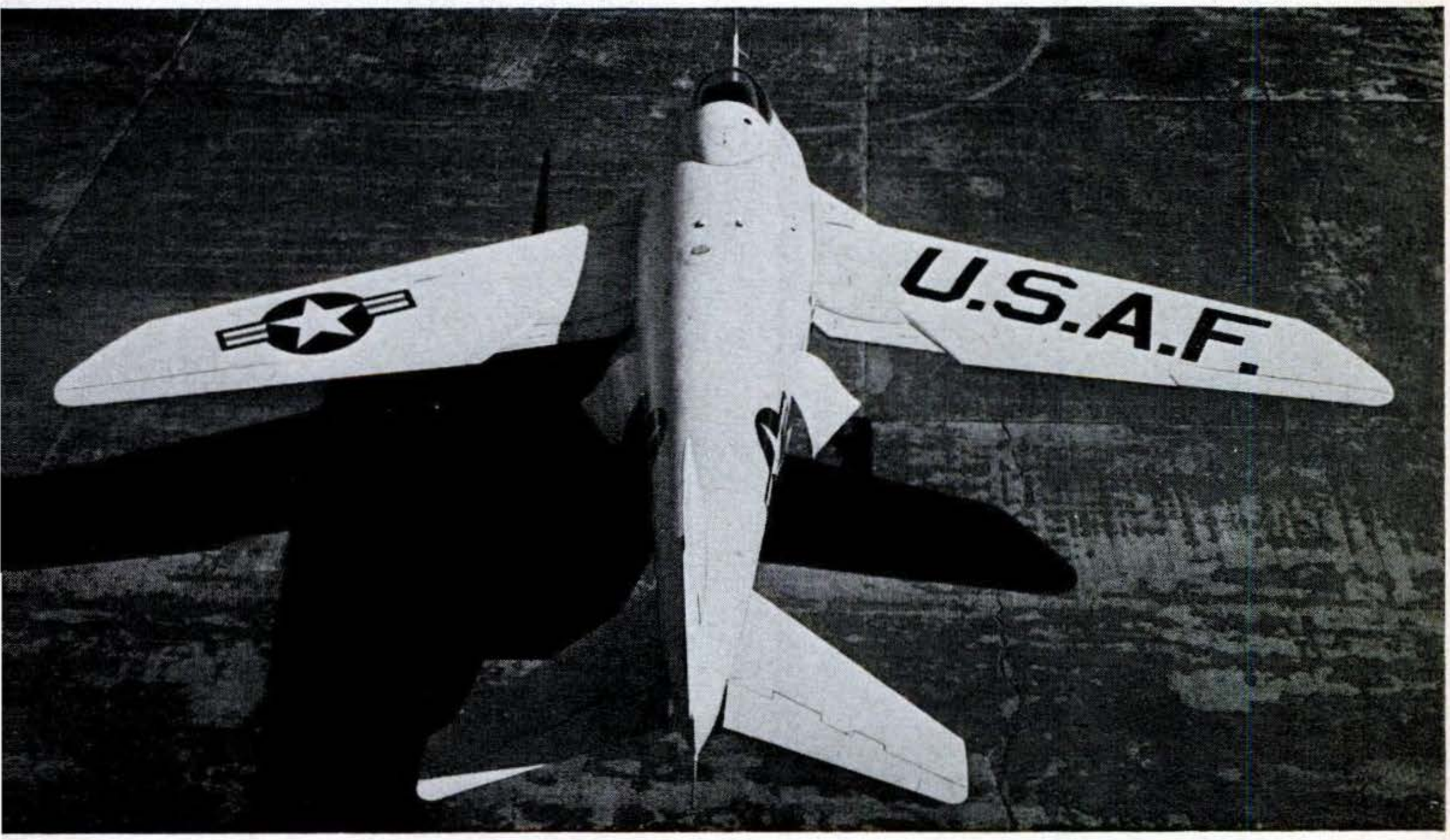


Swept back, X-5's wings are positioned for high-speed flight. Dive brakes slow its speed.

Moved forward, wings let plane fly slower, climb faster. Needle nose measures the air speed.



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Armored Carrier Gives GIs Lift

INFANTRYMEN get an armor-protected ride smack up to enemy nests in the Army's new personnel carrier. It takes the footsloggers right along with the tanks, protecting them from shrapnel and small-arms fire until they dismount for action.

The squad-size (eight-man) T18E2 is handled by a driver who also serves as gunner. Its .50-caliber machine-gun armament is for antiaircraft use. Fully tracked, it can go anywhere tanks can go and does better than 35 m.p.h. on good roads. Armor extends all around and also overhead, important for protection from the deadly proximity-fused shells that burst a few feet above the ground.

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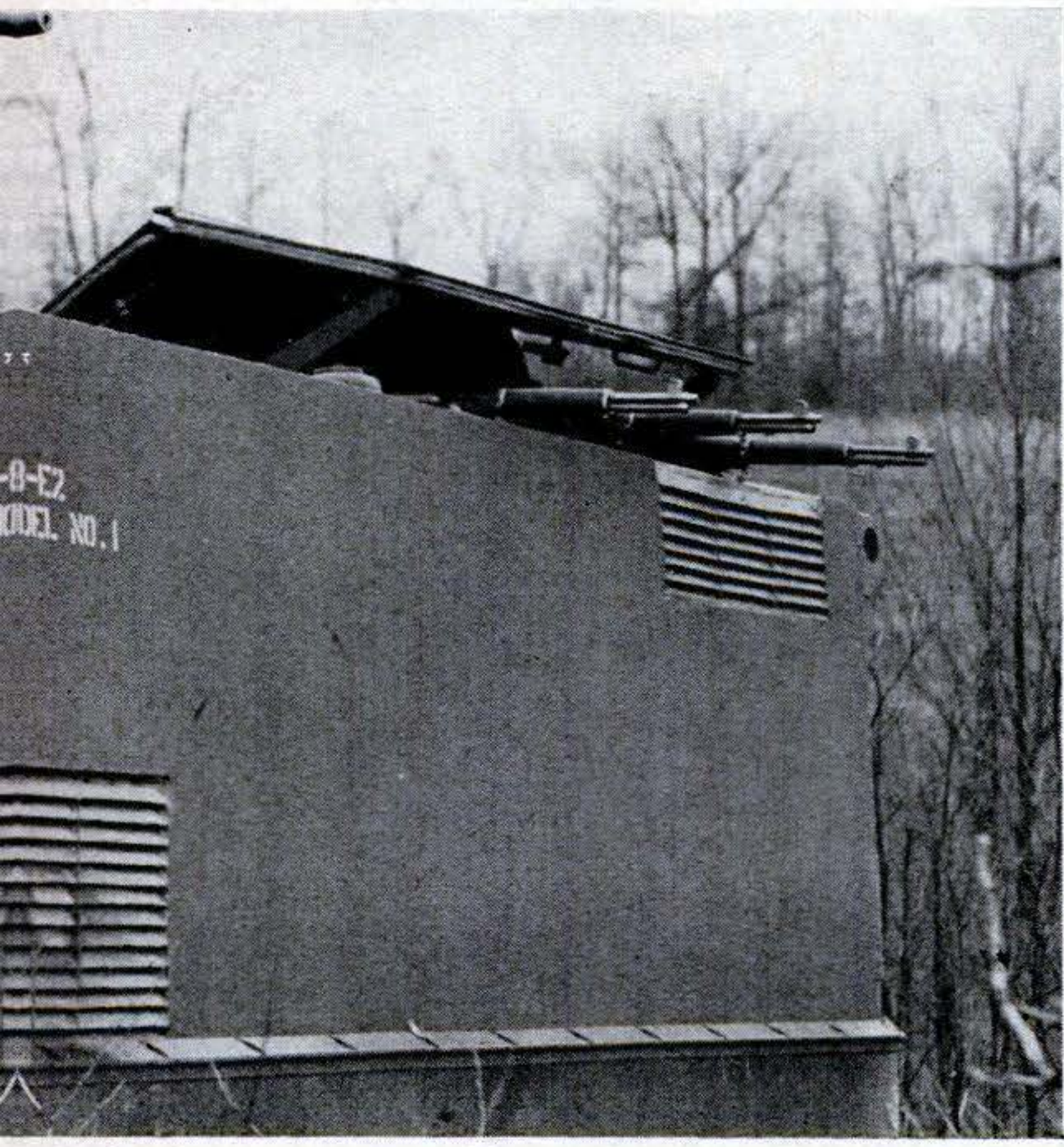
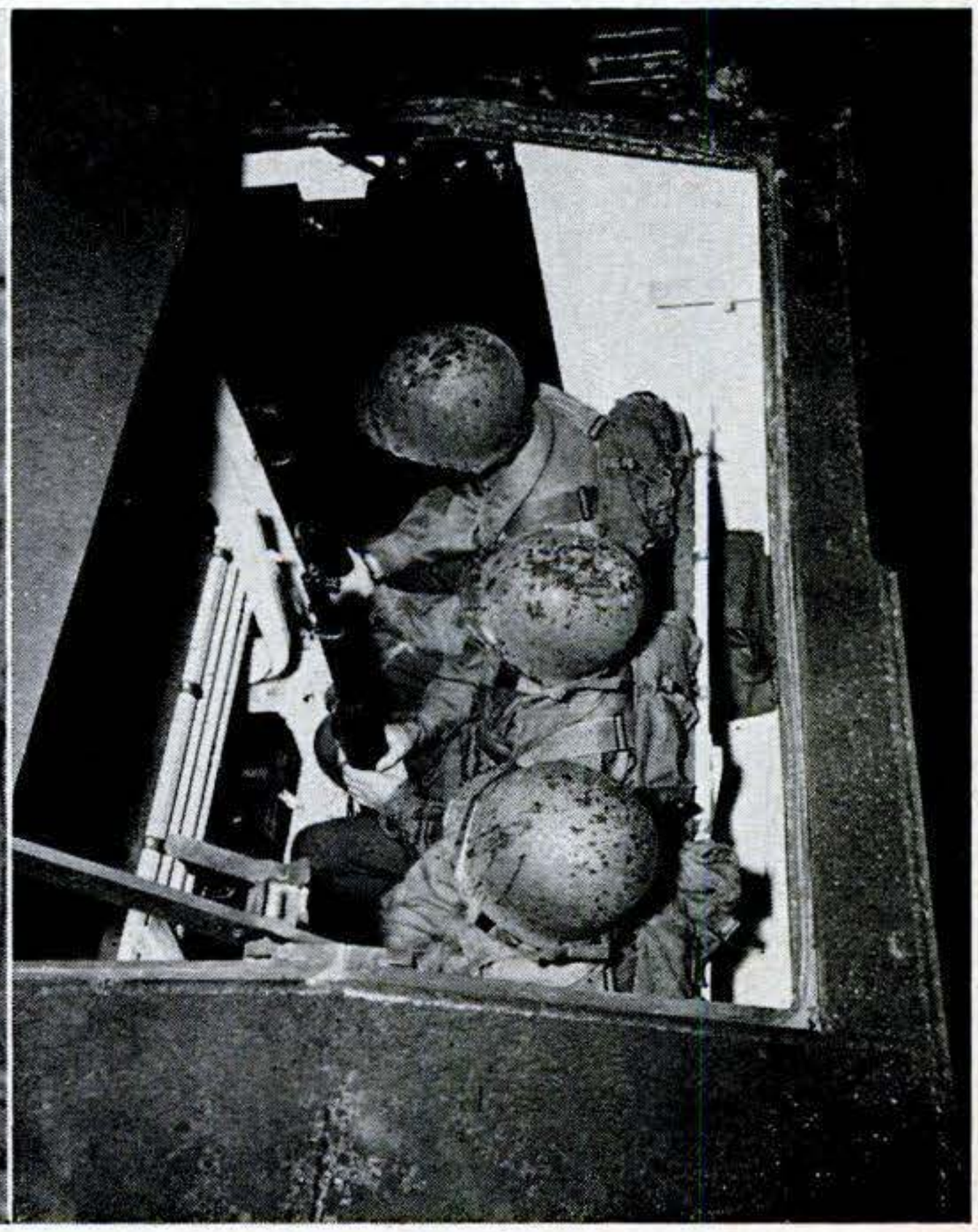
Troops dismount from carrier's double rear doors, above, to go into action as on opposite page.

Riflemen within armored vehicle find points of vantage at side ports, which may be fixed partly closed, as shown below, or opened wide.

Seating arrangement is shown below in photo made through wide-open rifle port. Six-cylinder Continental engine powers the carrier.





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Refrigerator Serves as Dining Table

PREPARING a quickie breakfast is no problem on this dining table that includes its own built-in refrigerator. Made in Australia, it has an electric fan to circulate chilled air through the food storage compartments, plenty of space for freezing trays, and a power outlet in one corner for a toaster or table-top grill.

Giant Oven Bakes B-47 Gas Tanks

INTO the cavernous opening above goes the fuel tank of a B-47 Stratojet to be vulcanized. Recently installed by U. S. Rubber to handle the self-sealing fuel cells of big Air Force bombers, the vulcanizer is 48 feet long, 15 feet high, and weighs 156,000 pounds. The circular door alone, seen in raised position, weighs 14 tons.

Power Conveyor Unloads Plane Fast

IT OFTEN takes longer to unload cargo from a plane by hand than it took to carry it to its destination in the first place. The powered conveyor above, at Kelly Air Force Base, Texas, licks this problem. It can unload 2½ tons in eight minutes. Rollers, powered by a 3 h.p. motor, carry crates at a 25-feet-per-minute clip directly to the terminal. When not in use the conveyor telescopes into its rear section inside the terminal building.

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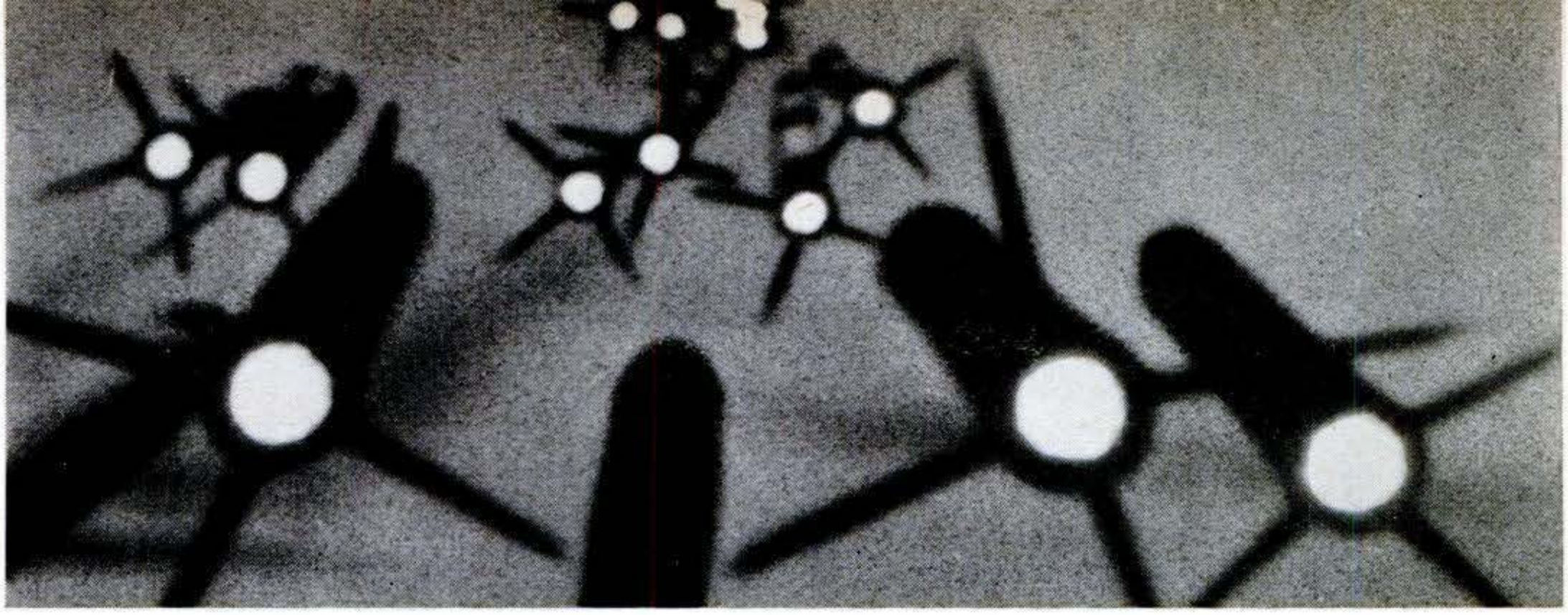


Fighter Fires Rocket Missiles Like Machine-Gun Bullets

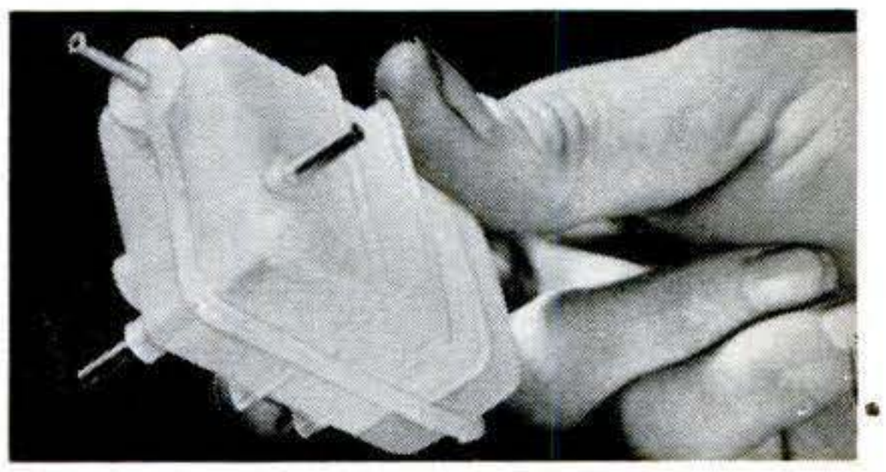
TAILS aflame, 16 "Mighty Mouse" rockets speed through the air in the spectacular photo above. This is how they'll look to the pilot of an F-86D interceptor when he looses a salvo against an enemy bomber. A movie camera, carried in a special wingtip pod, made the picture to record the rockets' dispersion pattern.

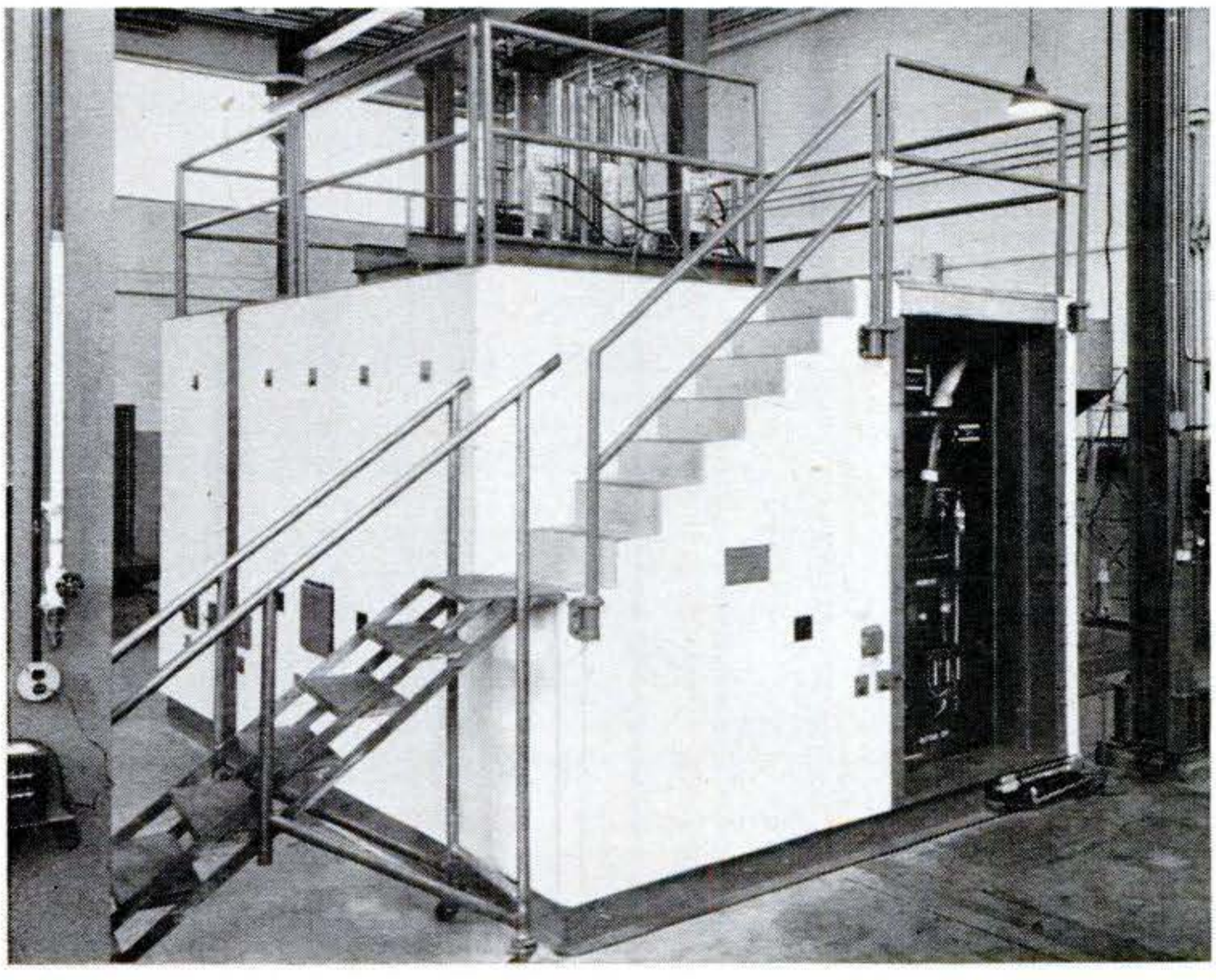
A "rocket gun" on the F-86D, reportedly ready to be tried out in combat, hurls these 2.75-inch missiles almost like machine-gun bullets. Instead of being conventionally mounted beneath the wings, two dozen rockets are carried internally, eliminating air drag. The plane's gunlike rocket launcher spits out all 24 of them, or as many as the pilot chooses, in rapid-fire succession.

A "Mighty Mouse" rocket can score a kill without making a direct hit, for a proximity fuse explodes its high-explosive warhead when it merely passes near a target. Thus an F-86D, staying beyond reach of a bomber's guns and flying at nearly the speed of sound, can strike at a foe with a weapon more lethal than machine guns or aircraft cannon.

Plastic Tank Shows Model Plane's Fuel Supply

THE tiny transparent-plastic tank at right lets you see how much fuel your model airplane has left. Since it is flexible, the tank resists damage in a crash. Unused fuel can be easily removed by squeezing the tank and forcing it out. It's made by Sullivan Products, Philadelphia.





Atom Pile's a Cutie

CLEMENTINE, only atomic pile of her kind in operation, is the belle of the Los Alamos Scientific Laboratory in New Mexico. She's a "fast reactor," a type in which the fission of plutonium yields fast neutrons to sustain the chain reaction. Liquid mercury serves as her coolant, a departure from water or air cooling in conventional piles. Steps lead to control mechanism, which has been modified since this portrait of Clementine was made.

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THIS CAR'S A Bulinformercillac

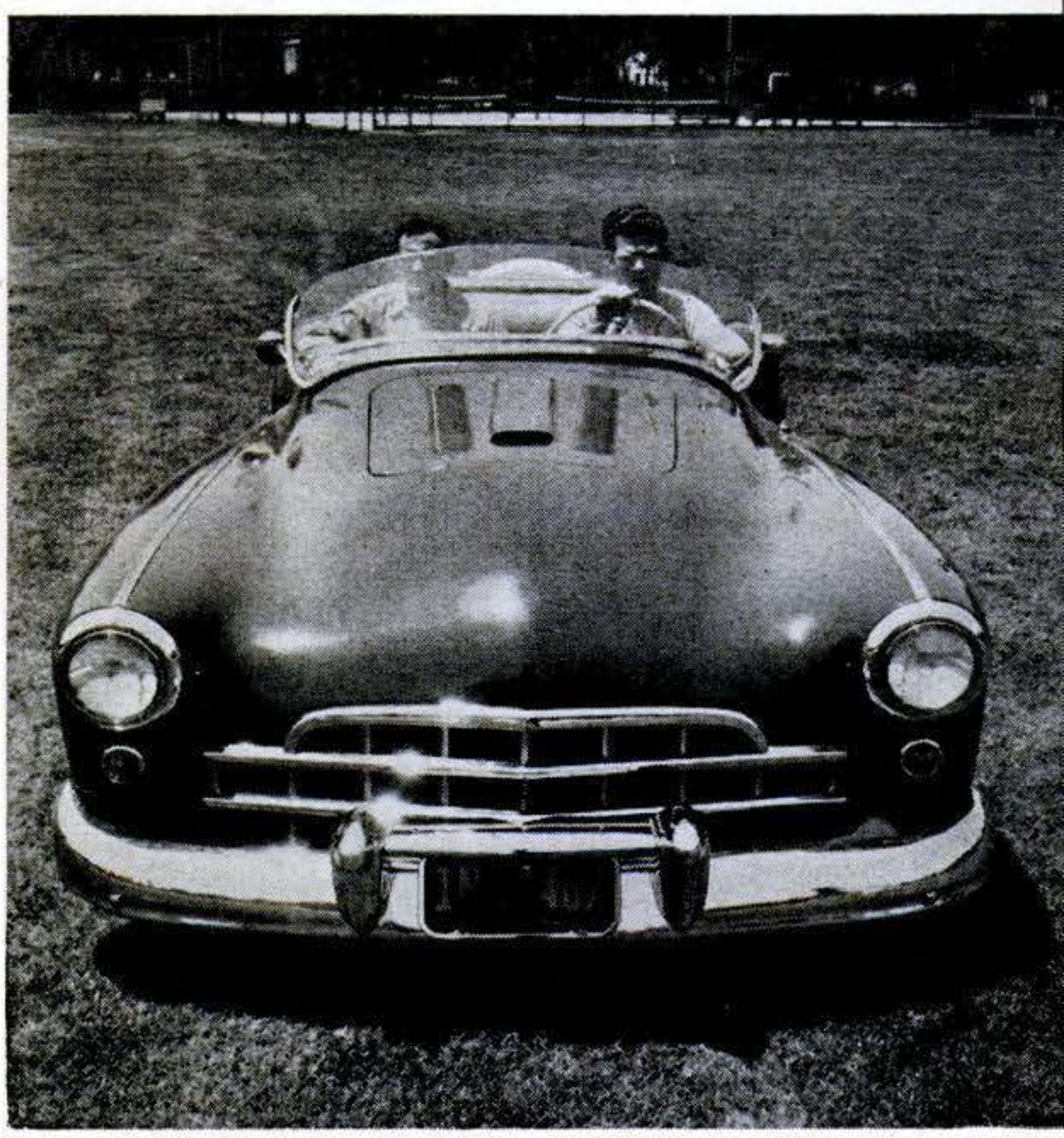
Can't pronounce it? It's short for the five cars that make up this super job.

WHEN the Leroy J. Viersens—father and son—started out to build a convertible that would look like none other, they didn't expect to rebuild the car half a dozen times before they were finished. But they did just that—to be rewarded when Hollywood columnists selected the car as the "convertible of the year."

A doorless red sportster, it combines the styling features of several standard U. S. cars of yesteryear. Home-tooled paneling knits together '48 Buick front fenders, '48 Lincoln Continental rear fenders, a '49 Cadillac grille, and a '50 Cadillac curved windshield. The body is seamless.

From the ground to the top of the windshield, the car stands only 50 inches high. Its wheelbase is 100 inches, and the overall length is 180 inches.

Viersen and his son, of Sun Valley, Calif., labored for 30 months before they were satisfied with the results.



Hood contours, bare of customary emblem, carry slight suggestion of first postwar Kaiser. Car has dual intake manifolds, special ignition, a Zephyr flywheel and clutch.

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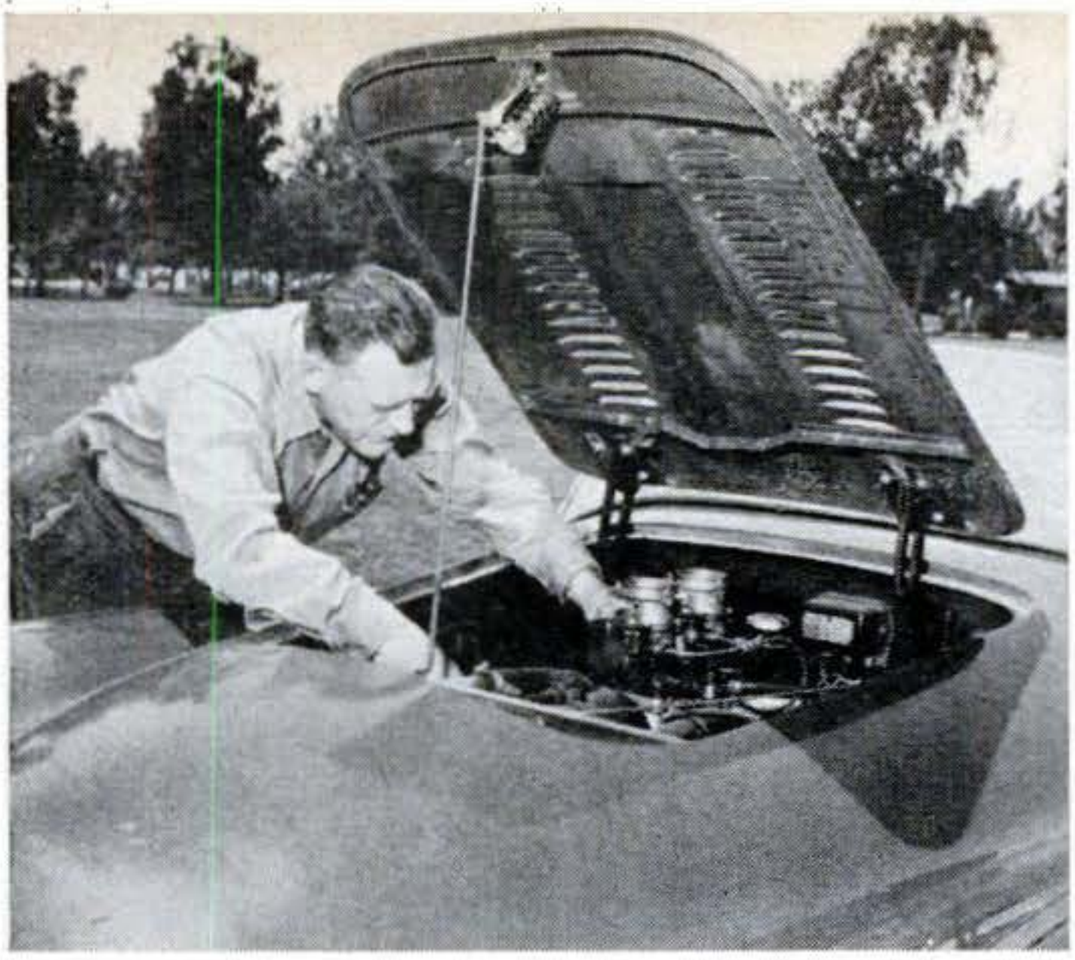
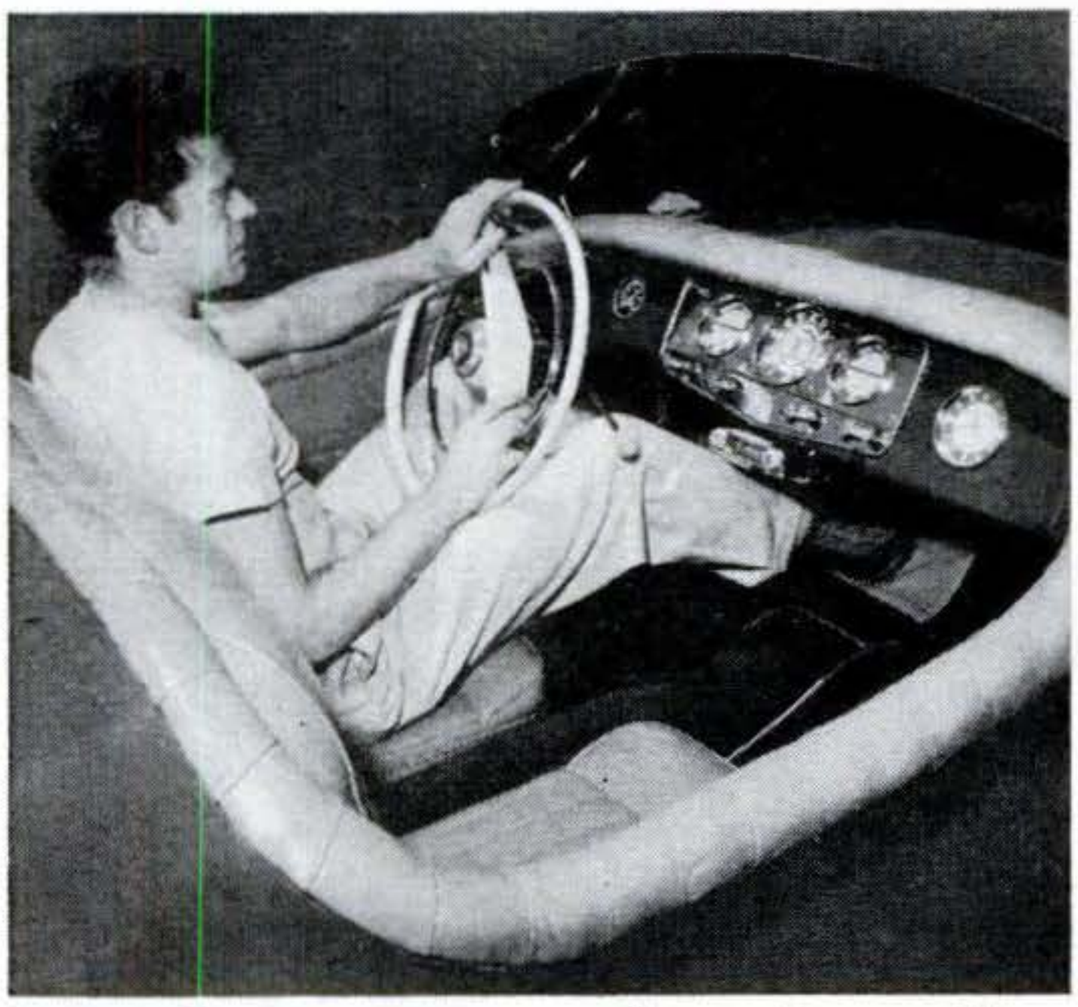
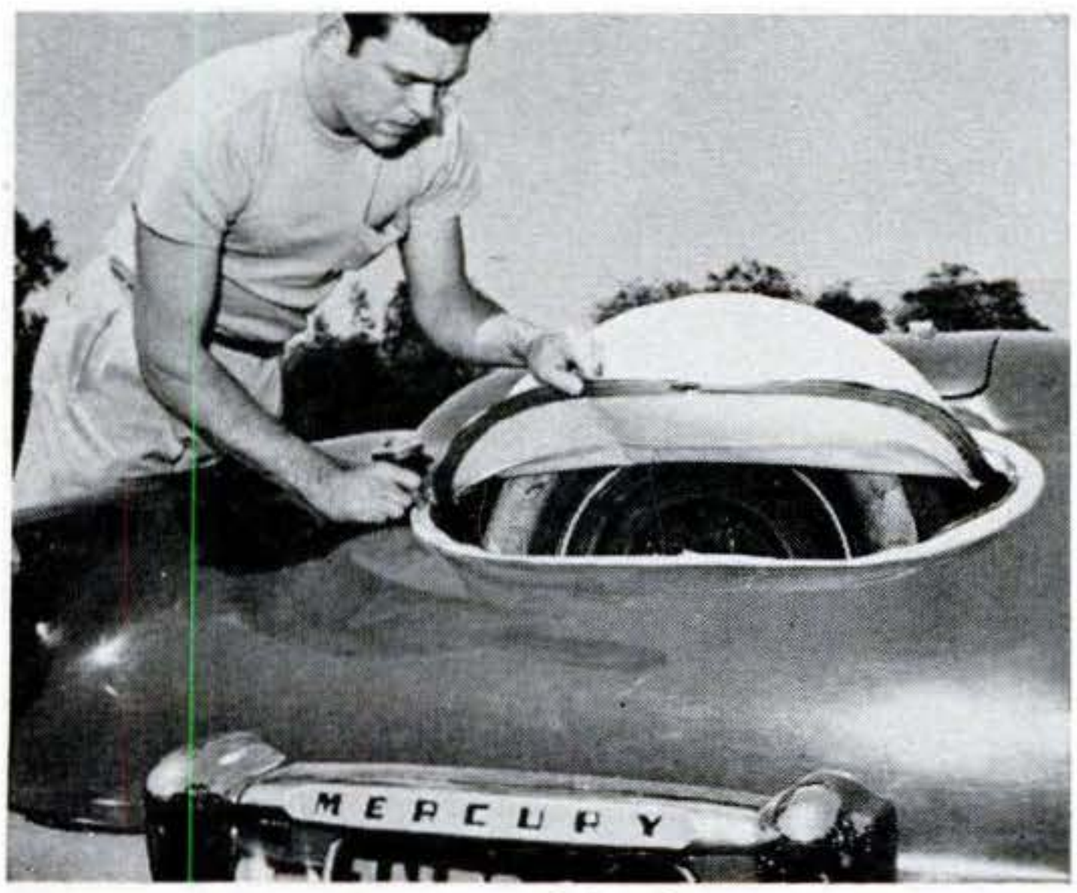


Small, louvered engine hatch is hinged at rear of hood. Built on a 1932 Ford frame, car is powered by a 1948 Mercury engine with special heads to provide a 9-to-1 compression ratio.



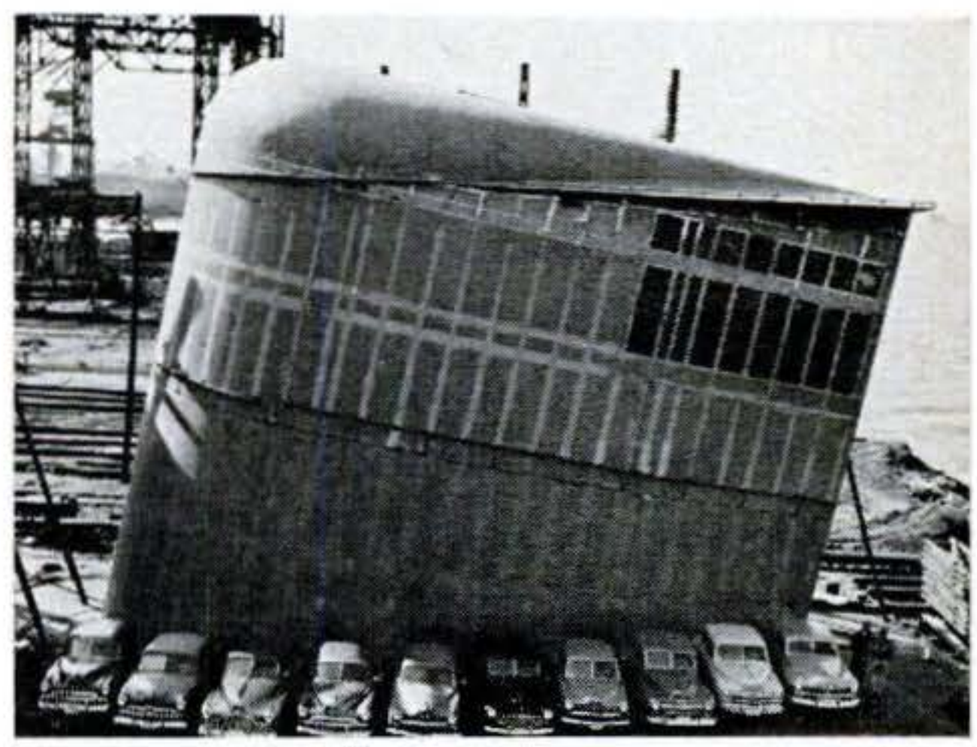
Leroy, Jr., occupies one of two foam-rubber, leather-covered seats. Instrument-board center panel is from '33 Auburn, rebuilt for '41 Buick instruments. Cockpit coaming is crash-padded.



Zippered hatch in turtleback opens to spare-tire compartment. A small door in front of hatch covers cache for jack, lug wrench, other tools. Car has 15-inch Lincoln wheels.

Farm Silo Becomes Modern Home

IN CASE of a housing shortage, try a silo. That's just what Mr. and Mrs. Lee Andre did on the Radio Club Farm near Palatine, Ill. The silo at one time was used to store cattle fodder on the 85-acre farm. Then Jack Deynzer converted it into a modern three-level home. It contains 740 square feet of living space. Rental: $135 a month.



Ocean Liner Has 5-Story Stacks

THIS isn't a building about to fall on the cars parked around it. It's one of two giant stacks on the new ocean liner *United States*. The stack is more than 60 feet long and 55 feet high. The 990-foot superliner is the largest ever turned out in this country.

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Forward Air Controller (FAC) in Korea calls down an air strike on an enemy-held ridge in front of his position. He's a Marine pilot assigned to infantry. Corporal at right cranks radio generator. Pfc. in center is team's mortarman. FAC is key man in air-ground cooperation.

1 Infantrymen wait, below, as flame bursts from napalm bomb (right) dropped by Corsair now zooming up (white circle) through smoke from target hit by plane ahead of it.

2 Seconds later smoke and fire boil skyward as flaming gasoline spreads over target. Planes that made raid were directed by Forward Air Controller with men in the foreground.

He Runs an Air Force for Gravel Crunchers

The FAC is an ace-in-the-hole airman who produces planes when and where the ground forces need 'em most.

By Michael Amrine

IT WAS the sort of situation the Marines call "hairy." Sixteen thousand United Nations' troops—U. S. Army, Marines and British—were completely surrounded by Chinese Communists. Their only hope was to fight their way back through the Korean hills to other UN elements 10 miles south.

The weather was 10° to 15° below zero. Supplies were running out. The Chinese had attacked for several nights running. A fresh snowfall made every moving man as visible as an ink blot on a white shirt.

The 7th Marine Regiment decided to attack at dawn in an attempt to break through.

But four M-26 tanks and two assault platoons had barely started to move when the enemy opened up with automatic rifles and mortars from carefully prepared positions that the Marine artillery, blocked behind a ridge, couldn't reach.

In that "hairy" hot spot, the ground commanders did what many a Marine has done before and will do again—they called on a man known as a Forward Air Controller, whose job is, literally, to pull firepower out of thin air. The pictures across the bottom of these pages show what happened in the next few minutes.

3 Moving forward, Marine ground force closes in on Communists burned out of hiding. These three photos show actual Korean attack described in article that begins above.

FAC Is Seasoned Combat Flier

The Forward Air Controller carrying the point of this spearhead was scrappy young First Lieutenant Johnny Theros—a full-fledged combat pilot, although his wings got a little muddy during his service with "my friends, the gravel crunchers."

It's standard policy with the Marines, and now adopted by the Air Force, that Forward Air Controllers—who march, sleep, live and die with the ground troops—must be pilots. Then they know what planes can do with napalm—jellied gasoline—rockets, machine-gun fire, or bombs. The only thing Johnny Theros had piloted within the past few weeks was a jeep. He didn't know ground troops' troubles and tactics by hearsay or from a training manual—he had gotten it direct, and had it in his bones.

It's His Air Force

The planes that he called on for close support already had been assigned to a strike to coincide with the attack. When the "Fireguard" flight of 18 Corsairs from an airfield 60 miles away showed up (eight Skyraiders from the carrier *Leyte* arrived soon after), Johnny took over their command. For the time the planes are in the air over him, the FAC has a private air force.

"Hello, Fireguard Playboy," said Johnny

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Theros into his two-way, VHF line-of-sight radio. "Playboy" was the code name for the flight leader, and Johnny gave his own code: "This is Dudley 14 . . . What are you carrying? . . . Wag your wings as you come in . . . I'd like you to make a dummy pass first, compass 270 degrees, 35-degree glide . . ."

In a war fought according to the book, the FAC would give grid coordinates for location, but in this nonstandard war the maps weren't always good enough. That morning, as in 90 percent of other Korean close-support operations, the pilots zeroed in on their targets strictly through the naked eye.

Incendiary Chalks Off Target

The flight leader, Major John Skorich, wagged his wings to indicate agreement with Johnny Theros's orders and gave his planes' armament: "All GP loads." By "GP" he indicated they were "general purpose" loads consisting of 800 rounds of 20-mm. ammunition, eight high-velocity aerial rockets, and one or two 250-lb. napalm tanks each.

Skorich made one dummy pass, while Theros radioed, "Let go just above the rockledge . . . Watch for our troop line perpendicular to road . . . On first pass fire machine guns for marking."

Every third round of the 20-mm. is an incendiary, which helps both the FAC and the planes following the leader to know when the target is being hit on the button.

"Pull your nose up five degrees . . . that's it . . . good boy."

"Roger," said Skorich, and he fired, pulled up hard through Chinese automatic-weapons fire, and circled to come around again.

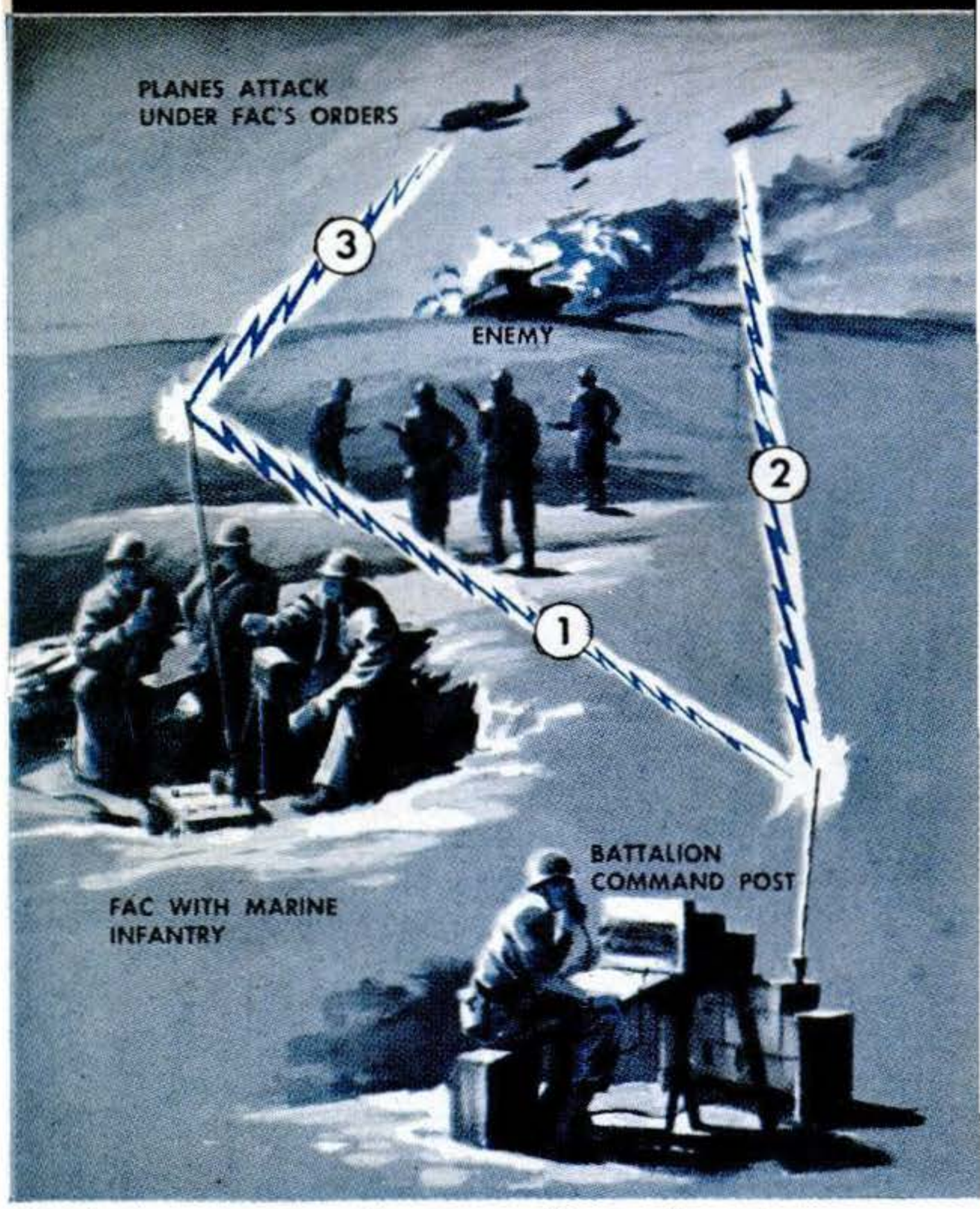
"This time give them napalm, and we'll come in with mortars and rifles."

Napalm bombs aren't barreled in from a fast dive-bombing run—they're just plopped down from a plane flying about as low and as slowly as possible. The forward motion from the plane runs the containers of "hot jelly" up to the target.

Chinese Come Out of Hiding

Napalm may be ignited from a self-contained fuse, or in some cases by small arms or other fire from the ground. When it splatters a tank, the slightest spark from the treads or its own guns will touch off certain, broiling death for the crew.

Three napalm bombs from Skorich's planes hit the button, and from all over the ridge Chinese took off. Marine ground troops and planes raked them mercilessly.



If planes are over front, awaiting orders, infantry asks Forward Air Controller for quick help. He radios request (1) to Battalion Command Post, which orders planes (2) to report to FAC. FAC tells them (3) where to strike.

Later, when Johnny-on-the-ground met Johnny-in-the-air by sheer coincidence, they naturally became buddies. But that morning, Skorich says, the flyboys were more afraid of Marine mortars than of the Chinese. "I told the mortarmen to aim at the tail of each plane as it zoomed away to make sure they didn't hit the next one diving in," Theros assured Skorich . . . "but maybe some of our men were too fast for you characters."

FAC Serves as Pilot's "Eyes"

The Marine Corps believes close-support planes are hand-to-hand weapons, the plane giving a hand to the man on the ground and the FAC being the pilot's "eyes." But as one veteran Marine pilot told me, "Personally, I like to see our own men and the enemy at the time I let go." And that was the case in the combat incident just described—when the hedgehopping Corsairs raked the Chinese positions.

And that's how close the close air support was as the Marines broke out of the pocket and joined up with other UN outfits to regroup for a counterattack.

Because the strategic bombers could not

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ORBITING PLANES AWAIT ORDERS TO STRIKE

PLANES TAKE OFF FROM AIR FIELD

5

ENEMY

1

FAC WITH MARINE INFANTRY

4

DIVISION: JOINT COMMAND CENTER

BATTALION

2

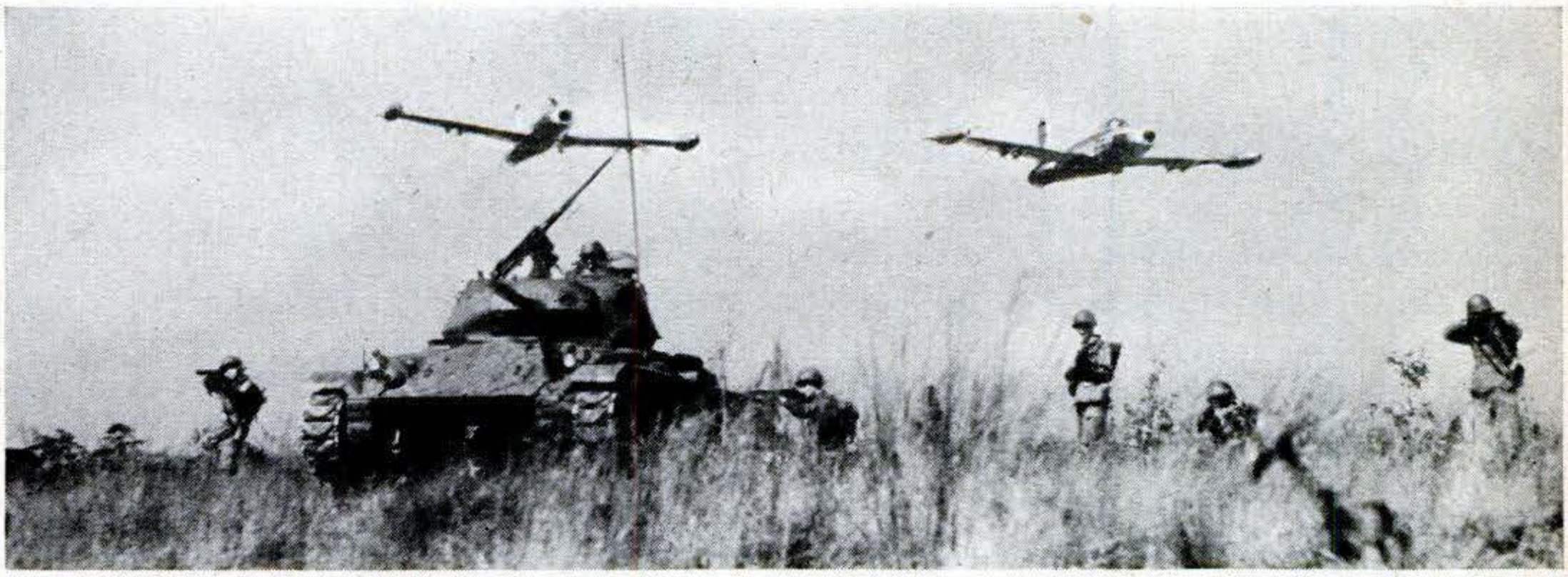
3

REGIMENT

If planes aren't immediately available, FAC's request (1) goes through Battalion (2) and Regiment (3) to Division, where Joint Command Center allocates air strength. These points may veto request: all planes may be busy, or brass may decide job is one for artillery. If request is okayed, JCC assigns planes already in air or orders a new flight (4) to take off. Even then, planes may be over target in 10 minutes. There, again, FAC takes over (5).

operate to great effect at this stage of the campaign, and because our side had complete air superiority, close support became the No. 1 job of air power in the Korean war. In the first six months alone, the Air Force flew 27,000 close-support sorties and the Marines 12,000. The Navy also flew thousands.

With all the services, close support is built around precision timing made possible through a new communications system—much of which is still secret. But what makes the equipment work is the closest possible teamwork between FACs, whose life expectancy is about as good as the traditional artillery observer's, and their flying brothers whose iron nerves guide their planes to drop bombs in the enemy's lap. END



Air Force jets fly close support for an Army tank-infantry team in maneuvers. System for directing planes is similar to Marines' but geared to handle larger units over bigger combat area.

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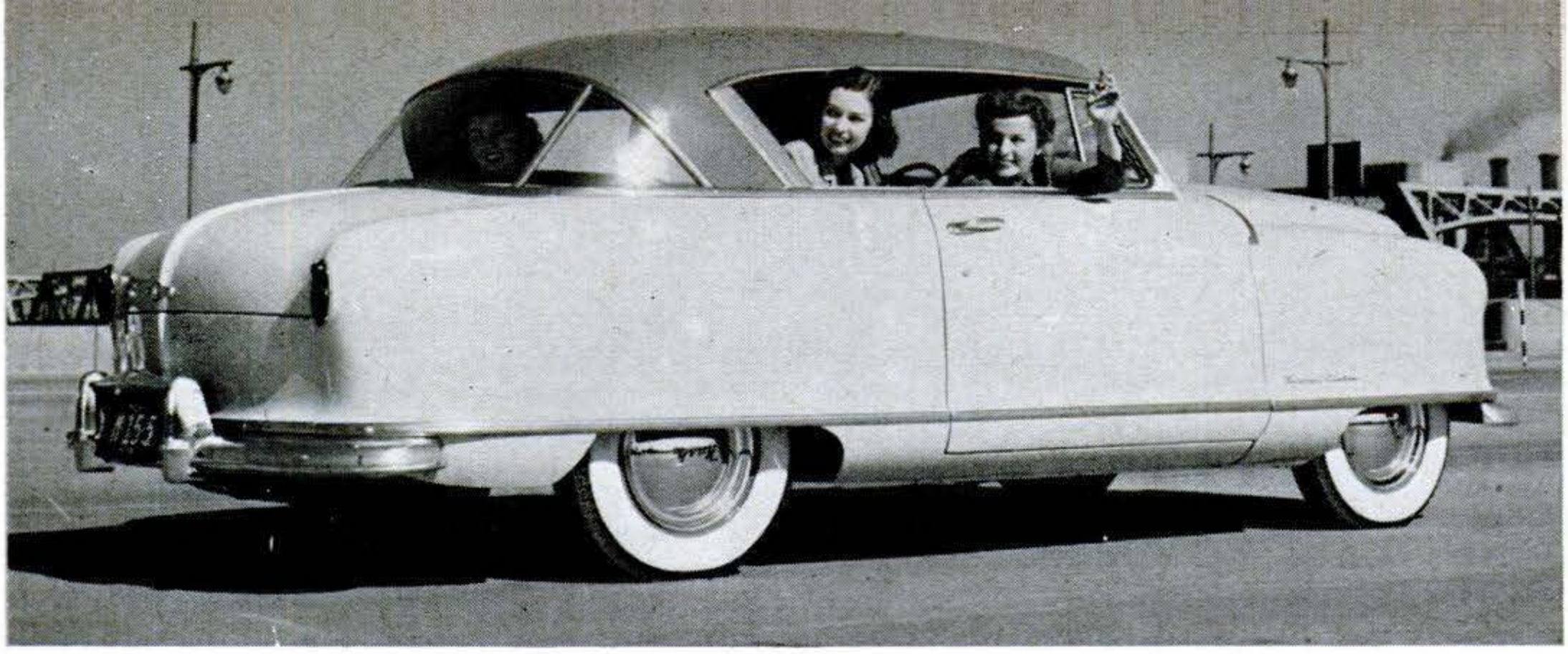
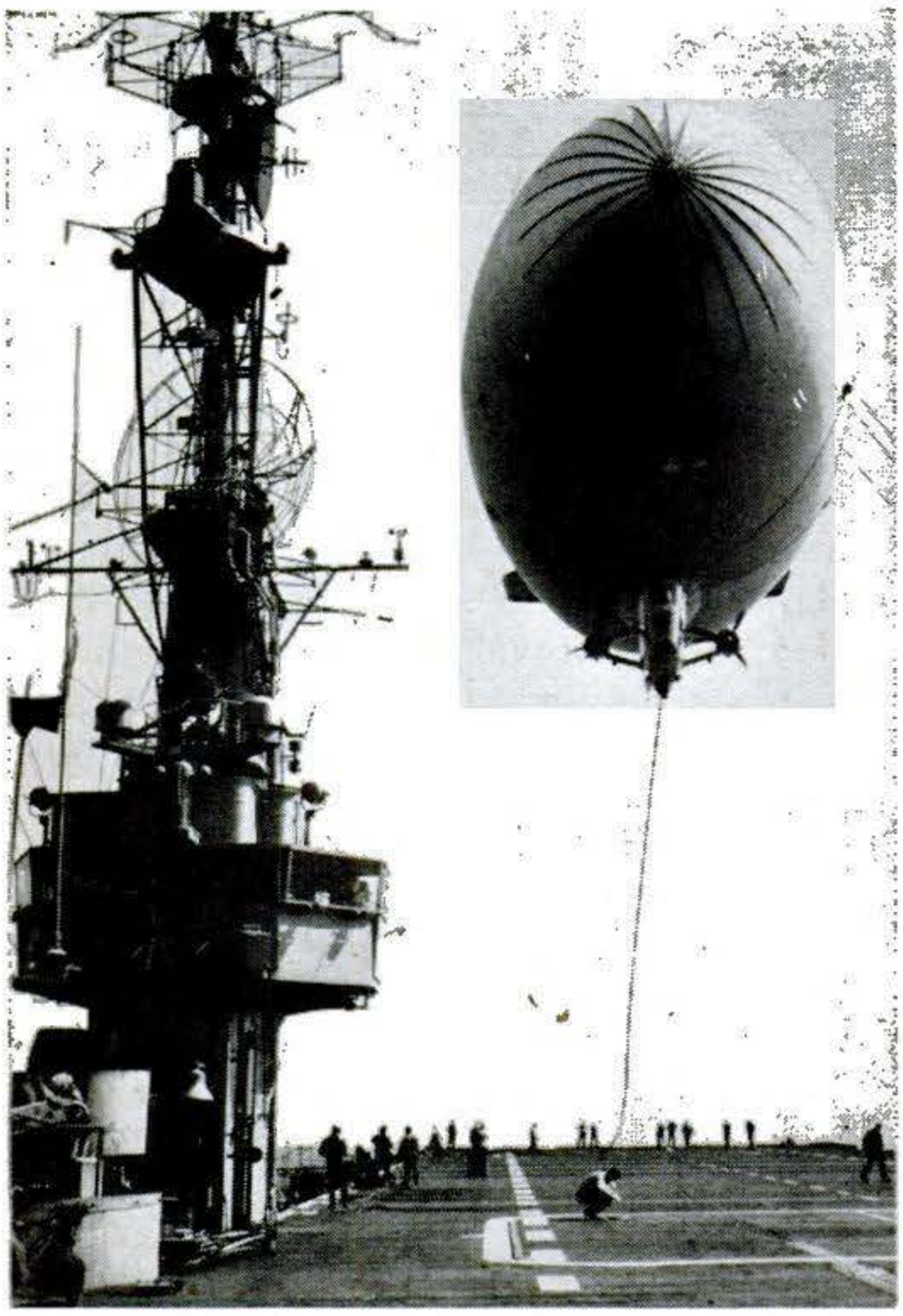


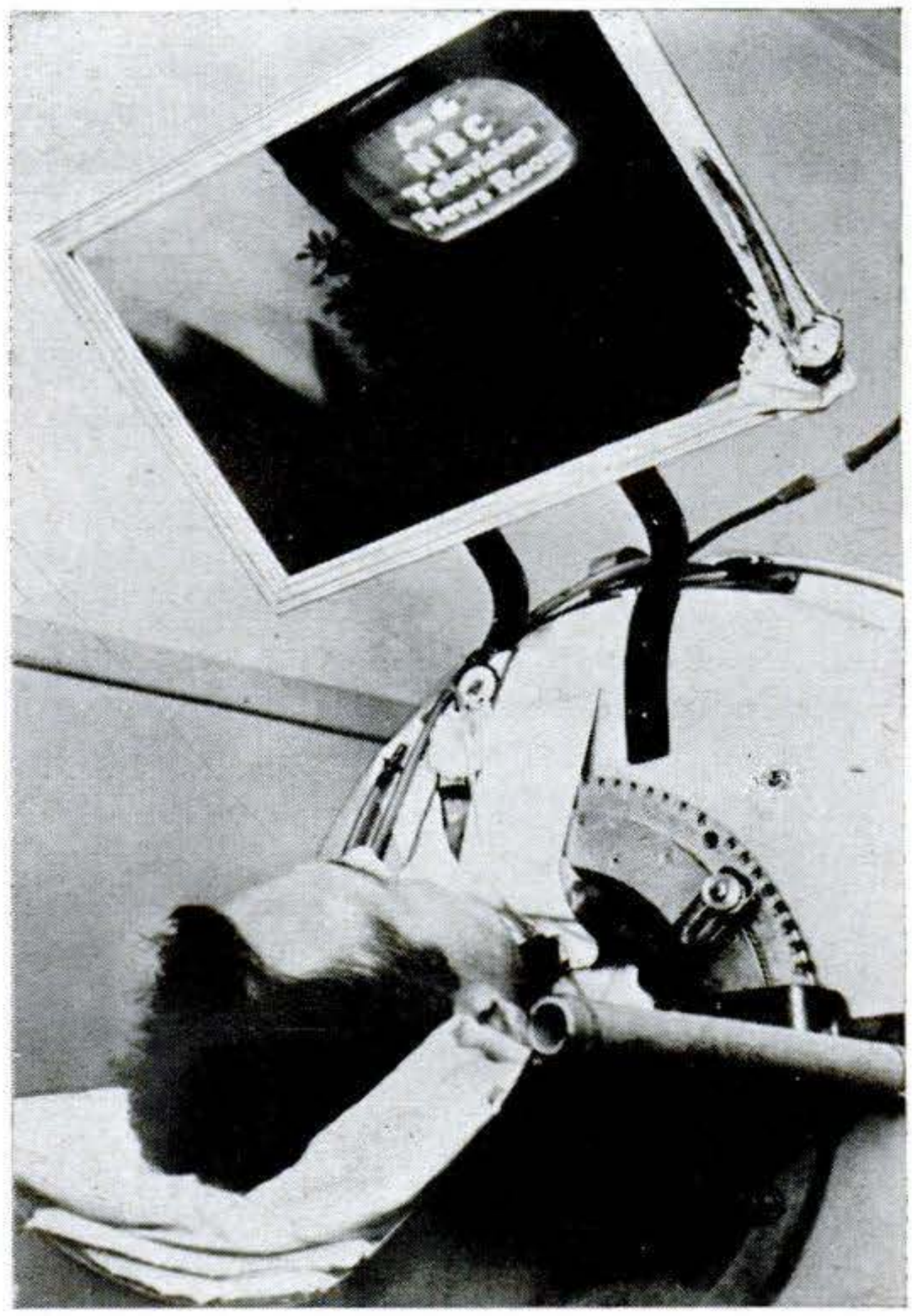
Rambler Adds Hardtop Convertible

LATEST addition to the Nash Rambler line is this Country Club make-believe convertible. Omission of the door centerposts, the one-piece curved windshield, and the three-section rear window make for good visibility. The all-steel hardtop model has an 82-hp., six-cylinder engine with a 7.25-to-1 compression ratio. The luggage compartment has 14½ cubic feet of space. Other Ramblers are a conventional convertible, station wagon, and suburban model.



Navy Blimp Refuels from Carrier

THE Navy blimp above is taking on a supply of fuel without actually landing on the aircraft-carrier deck. Flying low and maintaining the same speed and course as the carrier, the blimp first picks up the fuel line and raises it into position by winch and cable. Gas is then forced up through the hose by electric pumps.



Mirror Unscrambles Reverse TV

YOU'D expect the words on the TV screen seen in the mirror above to be in reverse. But a simple change in the horizontal sweep circuit results in a reverse image on the picture tube. This is then reversed again by the mirror, allowing Bob McKenna, a Navy vet confined to an iron lung, to enjoy his TV shows without becoming confused.

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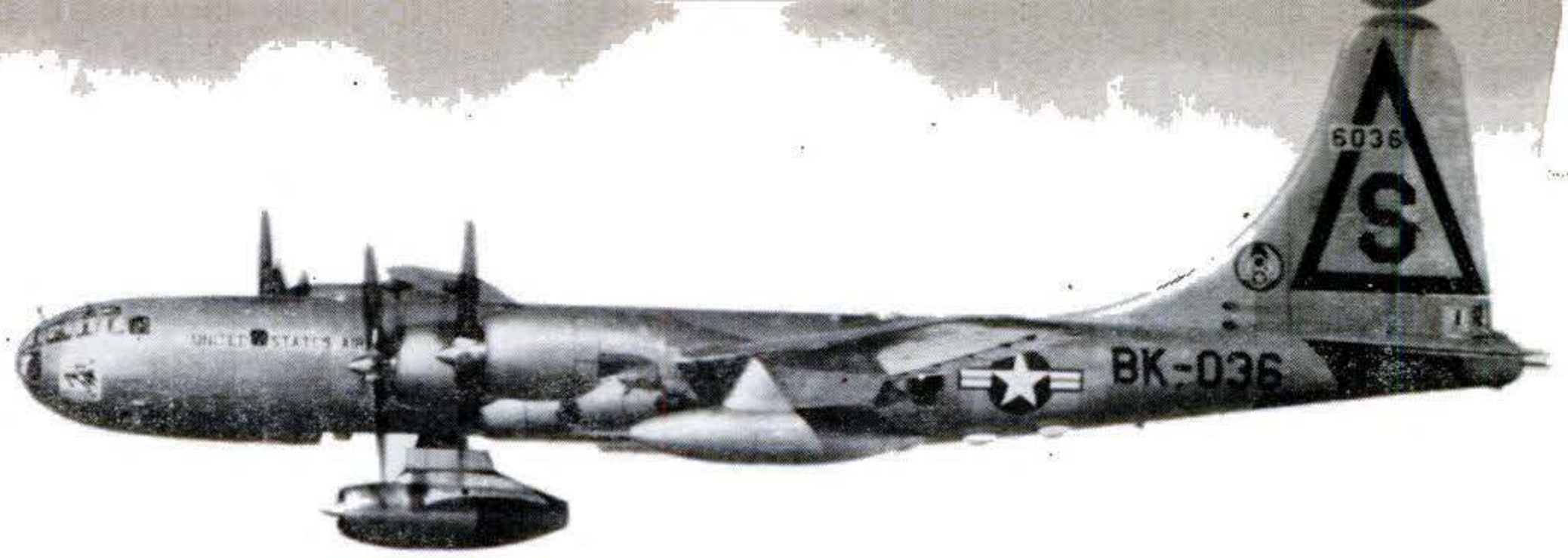
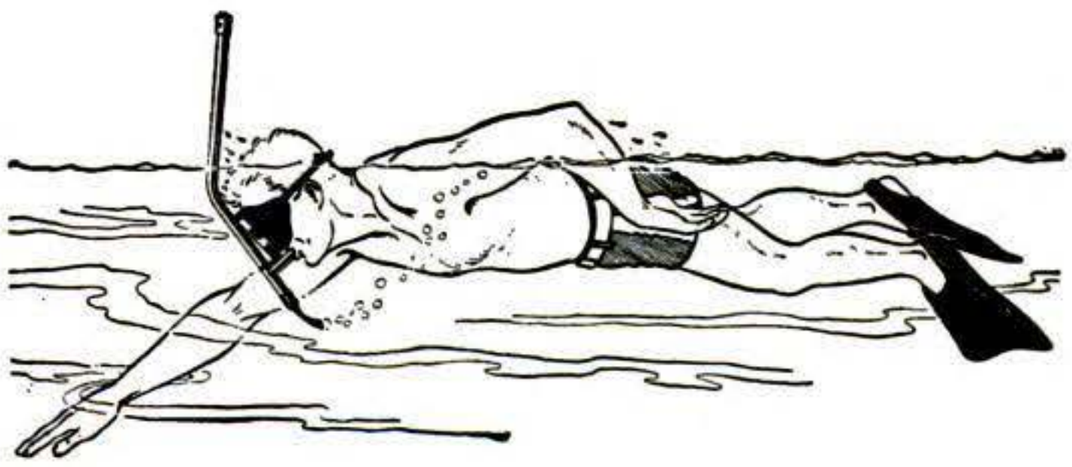


Engine Carried Like Bomb

To TRY out the Air Force's most powerful turbojet engine, it's being carried like a bomb by the specially rigged B-50 Superfortress above. The big plane serves as a flying test bed, taking off with the turbojet nestled inside the bomb bay, then lowering it into the open air for trials in flight. Under development by Pratt & Whitney, the J-57 Turbo-Wasp will power important new planes still secret. Its thrust far exceeds the 6,250-pound J-48, present titleholder.

Swimmers Get a "Snorkel"

BREATHE through the mouthpiece of a midget "snorkel" like a submarine's, and you can stay under water by the hour. For locating fish, or just for fun, it's sold at $7.50 by Abercrombie and Fitch, New York. At right, a well equipped swimmer uses snorkel, underwater-vision mask and foot fins.



Cave Yields U. S. Mummies

WHAT prehistoric Indians of New Mexico looked like may be revealed by study of two 1,400-year-old mummies discovered in a dry cave high on a mountainside by Chicago Natural History Museum scientists. Not only have their bones been preserved, but also hair, skin, nails and teeth. In an ancient burial rite, one of the desiccated bodies had been left wrapped in a fur robe and lying on a rush mat with a deer hide as a headrest. A cave explorer, masked for protection against surrounding dust of ages, is shown above examining his find.

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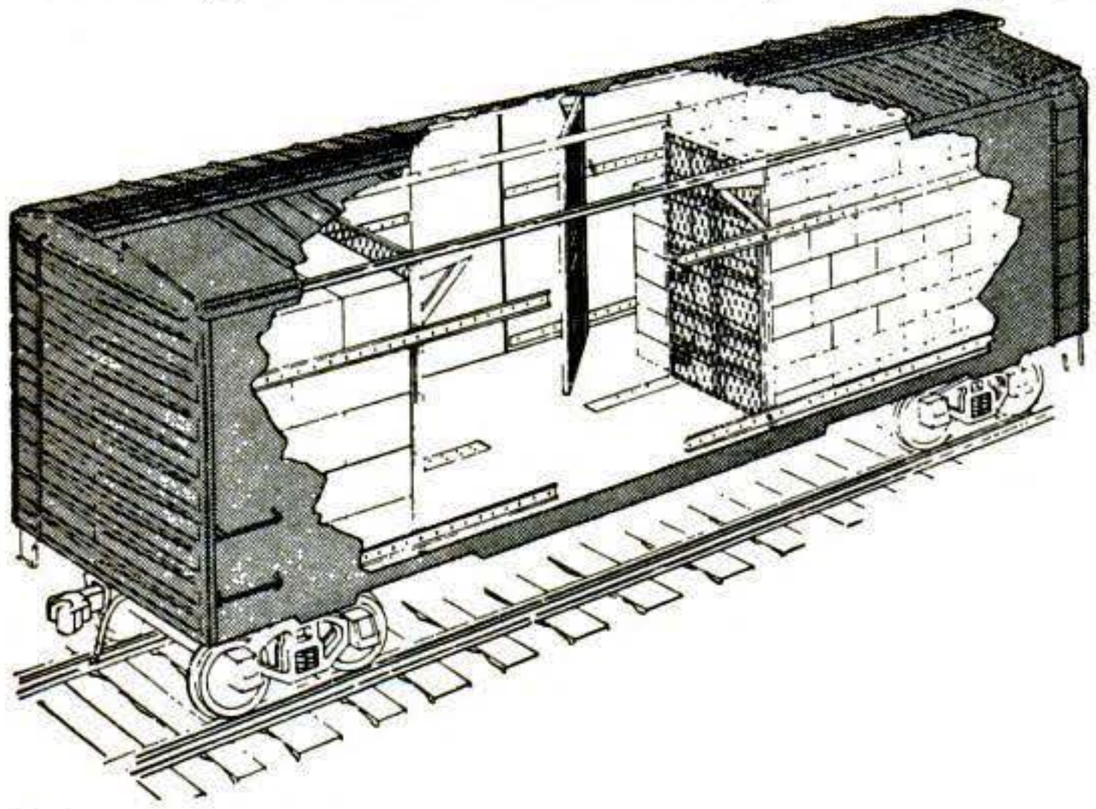
Natural View Decorates Glass Church

THE giant "showcase" above is actually a church built of glass. Overlooking the Pacific Ocean from a knoll in the Palos Verdes hills of southern California, the Wayfarers' Chapel offers worshippers a natural panorama of mountains, sea and sky in place of the man-made ornamentation of conventional church design.

Its architect, Lloyd Wright, has made the necessary structural parts simple and unobtrusive. Rising from foundations of native stone, treelike columns of laminated redwood support the plate-glass walls and roof. These are washed at the turn of a wheel by rotary sprinklers that have been installed along the crest of the roof.

Sliding Partitions Keep Freight Cargo from Jouncing



LOADS won't get jolted around and damaged in a freight car divided into sections with the steel gates shown at left. The gates slide along a trolley and lock against cargo that fills only part of a car—much as the adjustable "follower" in a filing-cabinet drawer holds loose cards or papers in place. Thieves will find their way barred, too.

For loading and unloading, the gates fold back against the car's sides. The Compartmentizer, made by Pullman-Standard, Chicago, can be used on any boxcar or reefer.

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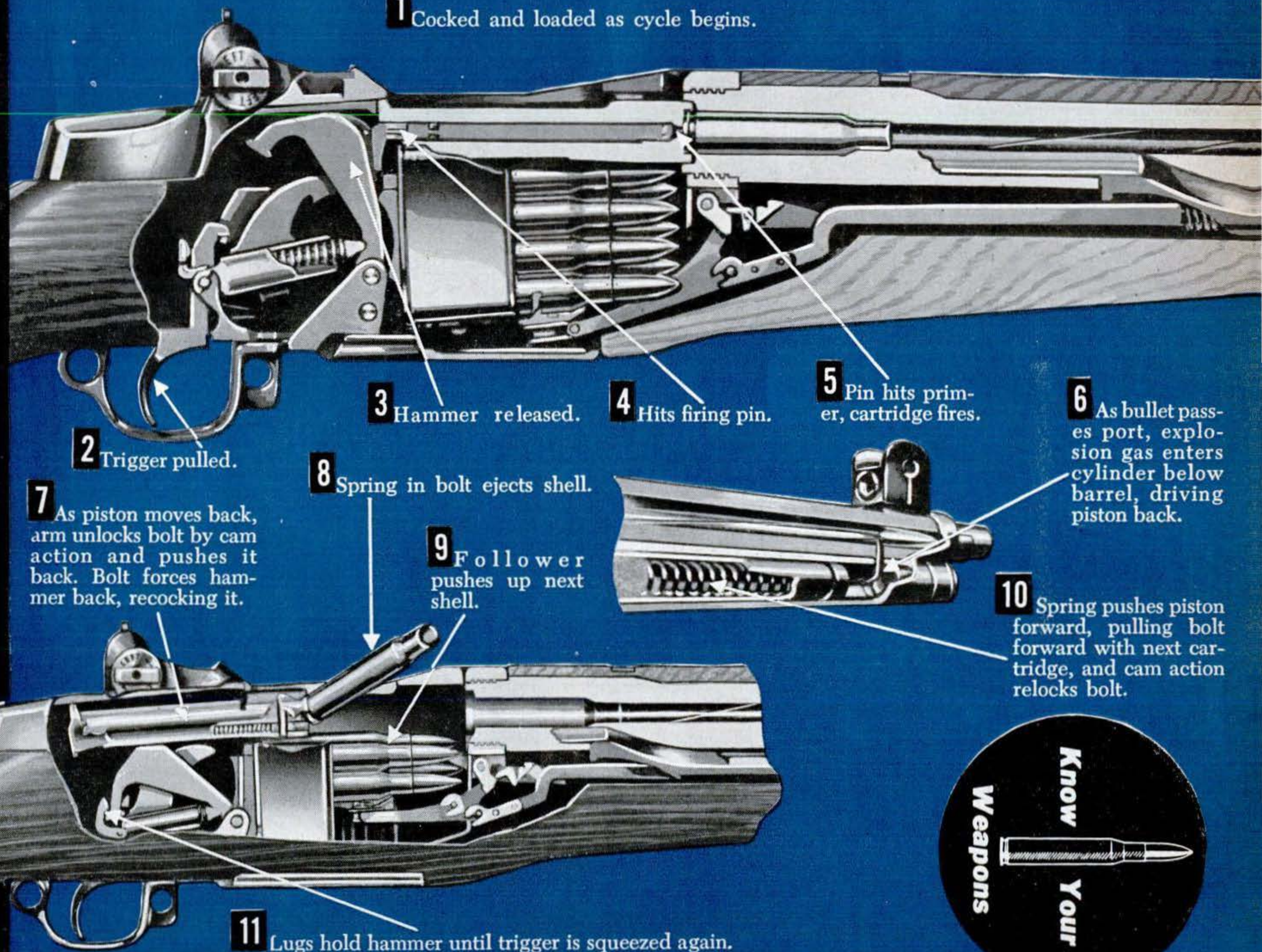
How the Garand Rifle Works

When the American doughfoot slugs it out with the enemy, his basic weapon is his M1 rifle, sometimes called the Garand after its inventor, John C. Garand, of the Springfield Armory. It fires .30-caliber slugs as fast as the trigger is pulled. The clip holds eight rounds. How it works is shown at right.



Know Your Weapons

They Make Dream Cars Come True

The Derhams will restyle your stock car, turn a Model T into a limousine, or build a custom job to your design.

By David A. Katcher

STRANGE as it seems, mass production of automobiles is making a market for custom-built cars. When six custom specials were recently displayed in a New York showroom, five were sold in the first hour and a half.

The reason? The more cars look alike, the more some people want *theirs* to look different so they'll stand out from the crowd.

The depression and war put most custom-body builders out of business. But one old-time firm that has survived to become a leader in today's fast-booming market is the Derham Custom Body Co., of Rosemont, Pa. Run by brothers James and Enos Derham, the shop gives beauty treatments to autos for folks who can afford to be different.

The Derhams have had to speed up production to make room on their factory floors for two dozen conversions already on order. But there's no danger that they'll try to compete with Detroit even if there are 40 people on their payroll. They do car-body jobs the car manufacturers cannot do as economically or as easily.

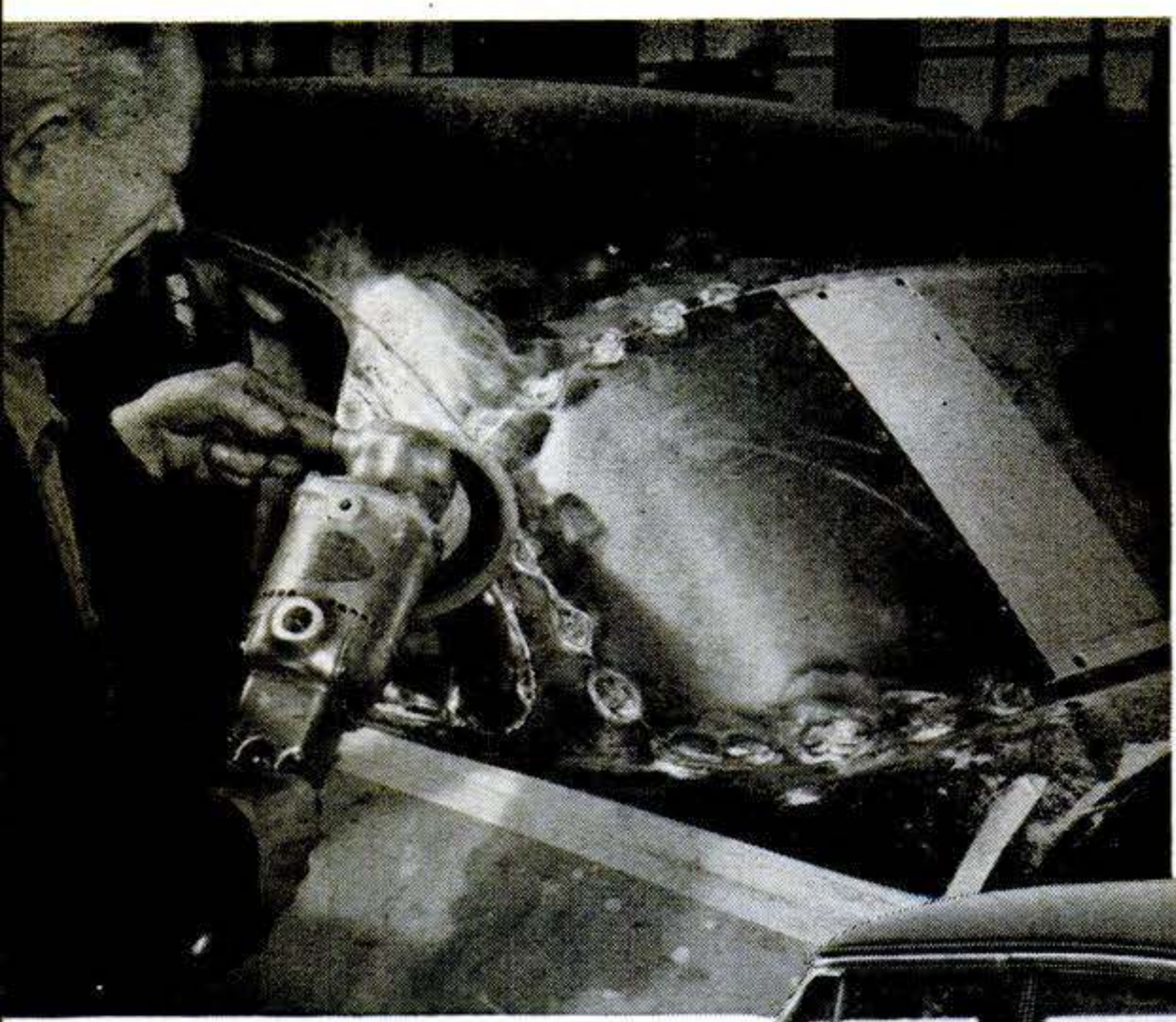
Each year about a dozen top men in auto concerns send their own cars to the Derhams for glamorizing. The big firms also send down to Rosemont to have sample cars made.

Cars for Celebrities

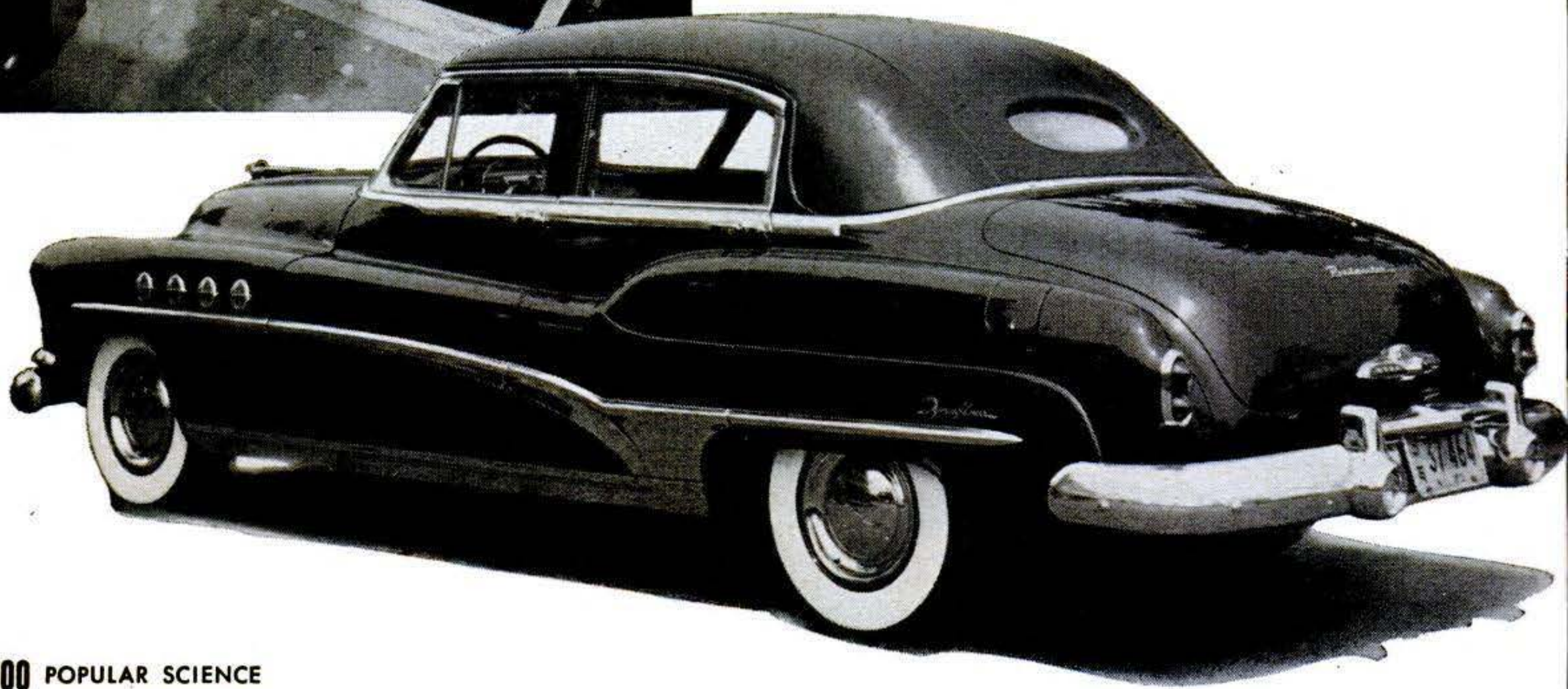
This famous little firm began catering to the carriage trade on Philadelphia's Main Line in 1887. It has been custom-building autos since the days when the boys in the shop argued about where the whip holder should be put on the new gas buggies.

Lily Pons, who had the firm build a panel brougham on a Packard chassis, once ordered a pair of carriage lanterns mounted on the side posts—and it was done.

The firm has the flexibility to put out what



A sedan outside, limousine inside, the Derham customized Buick below has hand-finished leather top and custom-built glass partition between front and rear seats. Worker at left smooths joints on blocked rear window.



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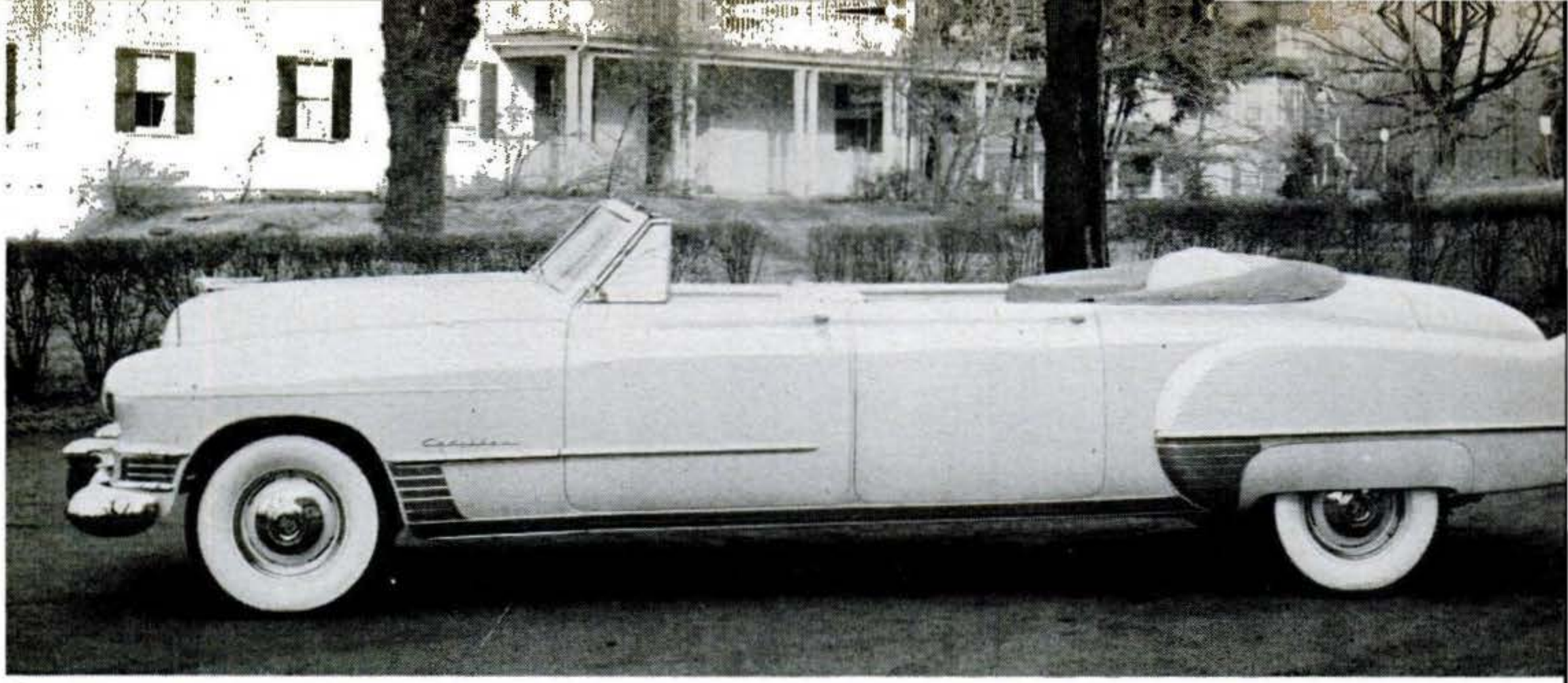
"Customized" stock model, from Monarch Buick, N.Y.C., sports cloth top, cane panels—$800.

people dream up because it does not have to retool between jobs. A Derham car may cost $40,000, as did an experimental model on a Mercury chassis for the American Sportscar Corporation. Or $20,000 for a complete custom-built body to owner specifications. Or a fraction of that for putting on a cloth top, or installing a chauffeur partition, or formalizing a limousine.

Hearse Becomes Land Yacht

Spectacular cars, for people all over the world, have come from the shop. His Highness, the Sheik of Kuwait, Sir Ahmad Ibn Jabir, couldn't live like a 20th Century sheik without a desert land yacht. What's more, he wanted one longer than any other in the Middle East. So the Derhams mounted a complete handmade, luxurious, peach-colored car body on a standard 163-inch Cadillac hearse chassis. They "desertized" the car and built in two radios and a siren. The

Bending drip mold into place. U-shaped channel screwed to metal top secures cloth. Upper side of U, folded down, covers screwheads and forms drip mold to carry off rain.



One of longest cars ever made, this convertible for the Sheik of Kuwait was built on 163-inch

Sheik really needed a desert in which to maneuver the result.

And there was a president of a big railroad who wanted his daughter driven to her debut in the style to which she was accustomed. Her mother, for sentimental reasons, wanted the driver to be the same old family retainer who had driven her to hers. But the old fellow could only drive a Model T. The Derhams fitted a $5,000 Rolls-Royce body to a Model T chassis that cost less than $400, and everybody was happy.

This disemboweled car is being armored with laminated Fiberglas. Note strips welded to door frames to thicken them. The doors are sliced top to bottom like so much cheese, then thickened to take heavier regulator mechanisms and thick bulletproof glass.

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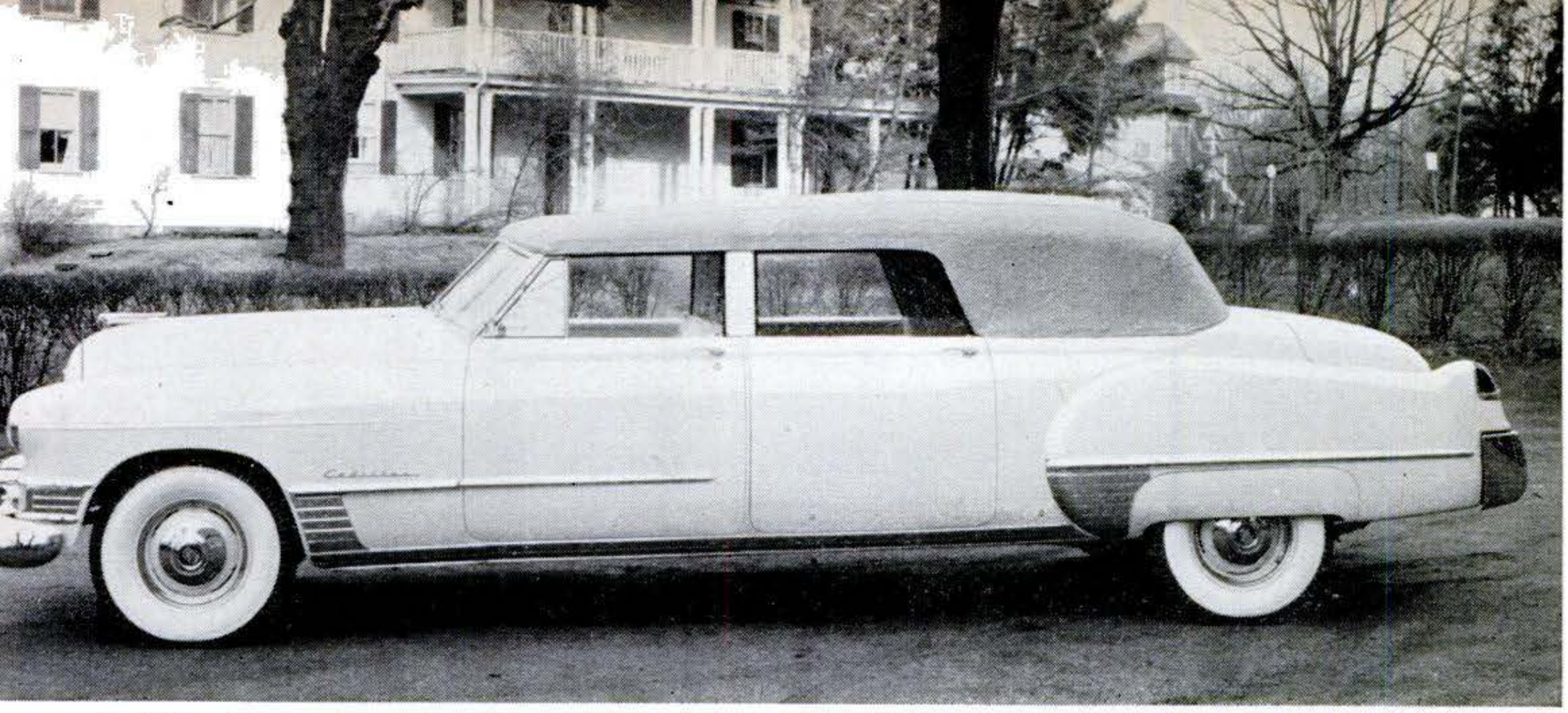

Cadillac hearse chassis. When car is closed, tight-fitting top and windows seal out desert sand.

But the bizarre and unusual are only part of the story. The Derhams build the luxurious, the just plain different, and special models for handicapped people or for experimental purposes. Cadillacs, Chryslers, Packards, Lincolns, Buicks and Dodges have been among the chassis that they have often converted.

From Hopalong to Uncle Joe

Customized or modified cars by Derham have gone to join the presidential fleet at the White House, to the Pope, to an Indian Maharani, to Hopalong Cassidy, to the Duke and Duchess of Windsor, to kings and queens, presidents of Finland, Lebanon, Haiti, the Philippines, Brazil and Venezuela, and to artists, movie stars, government officials, millionaires, and all manner of potentates including one named Joseph Stalin. The late Amtorg Trading Corp. had a seven-passenger limousine converted to an open touring car for him before the war.

In 1929, between 30 and 40 Duesenberg chassis were topped with custom-built bodies for the elite the world over. In 1931 only one was built. The depression canceled the customers. It took some ingenuity to keep it from canceling the firm.

Birth of a Big Idea

Enos, who is the designer member of the team, was sketching idly one day on an illustration of a stock car—like drawing mustaches on a billboard picture. He smoothed a line here, added one there. James, president of the firm and customer contact man, looked at the sketch. Then he and his brother looked at each other, and out popped an idea. If people didn't have the money to have car bodies made to order, maybe they'd pay for dressing up existing models. James lit out of the office to look for customers.

Today the bulk of the Derham business is modifying stock production cars. The three types of standard conversion ordered most often are: to cover hardtops with cloth that gives a car a neat, tweedy look; to make an ordinary limousine or sedan into a formal limousine; and to install glass partitions to seal off the front seat.

In covering an auto top with cloth, the Derhams most often apply Haartz cloth, the material used on convertibles. The cloth top is fitted over a flannel pad cemented to the metal and secured around the edge with an aluminum U-shaped channel, screwed down all around. The top side of the U is tapped down flat, which covers the screw heads and leaves a slightly curved L that serves as a drip mold. Then it's painted. The result? Something that looks different and classy.

Why Limousines Are Costly

Converting a seven-passenger limousine to a formal limousine—or even a sedan to a formal limousine—means ripping out the whole back interior of the car—seats, upholstery, windows and window frames. Metal panels are fitted and brazed in place where the side windows were. The big rear window is blocked down to a neat oval with a wooden form. The joints are ground smooth and soft solder wiped on to fill the cracks. Leather, with hand-stitched seams, is laid on the top over a felt pad.

The drip mold is bolted on, and chromium fittings, if any, are put in place. The upholstery is refinished to cover the newly blinded

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Raymond Loewy, industrial designer, had two of these built to his specifications by Derham.

portions in the rear, and the insides are put back in. The car has the Derham look and the Derham name plate on its hood. Milady can now sink back in her seat and be hidden from view even if the car is parked.

When 'James' Is Home

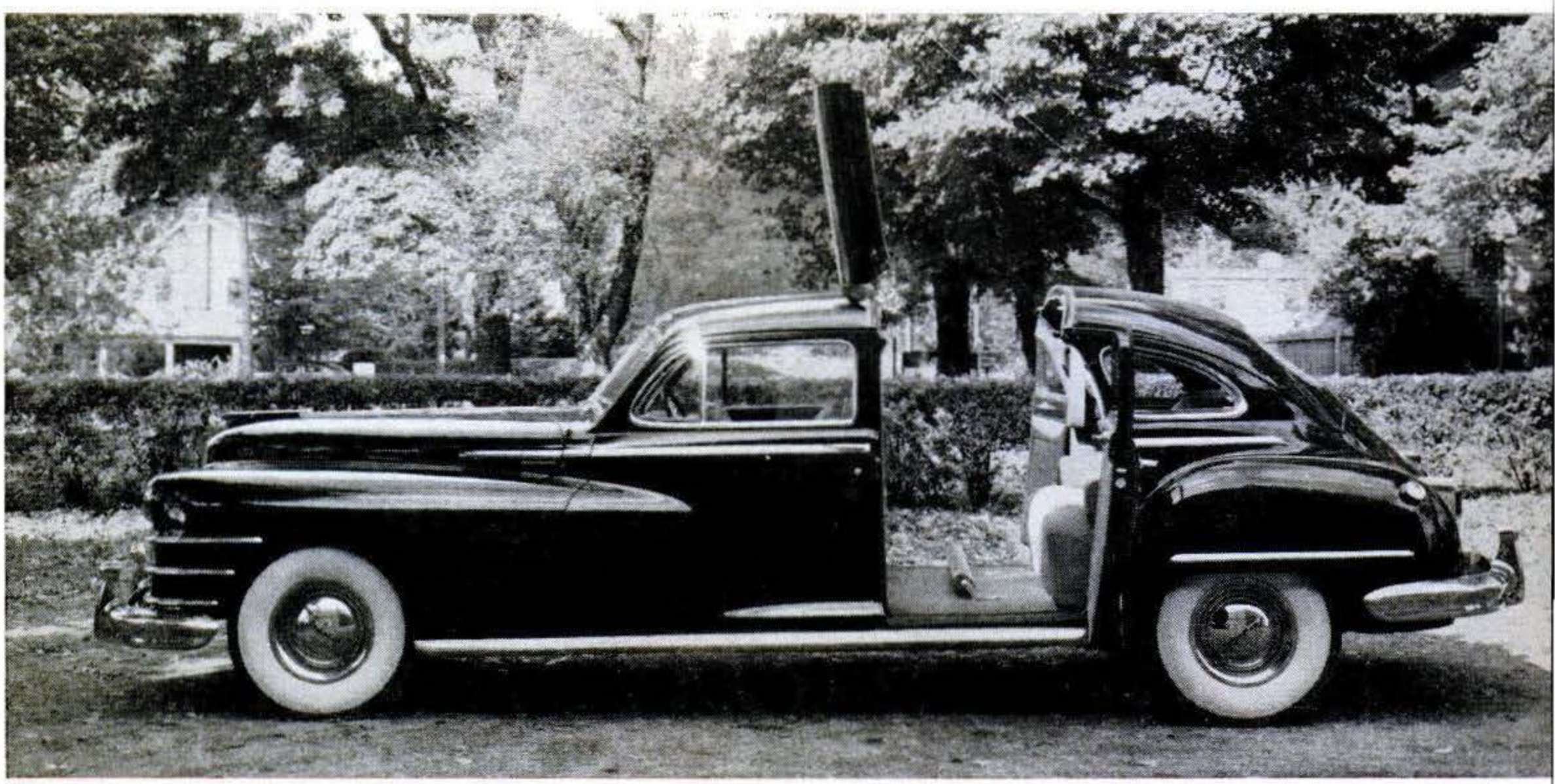
Seven-passenger limousines carry glass partitions to separate front and rear seats as standard equipment. But some people want a limousine inside and a sedan outside. Then the car can be driven by the chauffeur formally, or when the chauffeur is helping the gardener trim the begonias it can be driven informally by the owner.

People like these partitions because they give the passengers in the rear seat some privacy. The Derhams report that chauffeurs like them, too. They can keep their side windows open without sending drafts into the back, and they can smoke while waiting for passengers to return from shopping or the theater without smelling up the place.

The bargain-basement job is to install sliding glass panels, but most calls are for more elaborate rigs in which the glass disappears into the back of the front seat. The Derhams install a wooden frame, a regulator mechanism to move the glass up and down, and channels to hold the glass snugly.

Bullet-Proofing Concealed

While standard conversions may be the bread-and-butter work of the firm, the tougher special jobs are also compounded of tasteful design and craftsmanship—like ar-



Not all custom jobs are for looks. Modifications to aid the physically handicapped also are a large part of the Derhams' work. Here they built a hinged trap door into the roof of this big Chrysler to let an arthritis victim get in and out without having to stoop.

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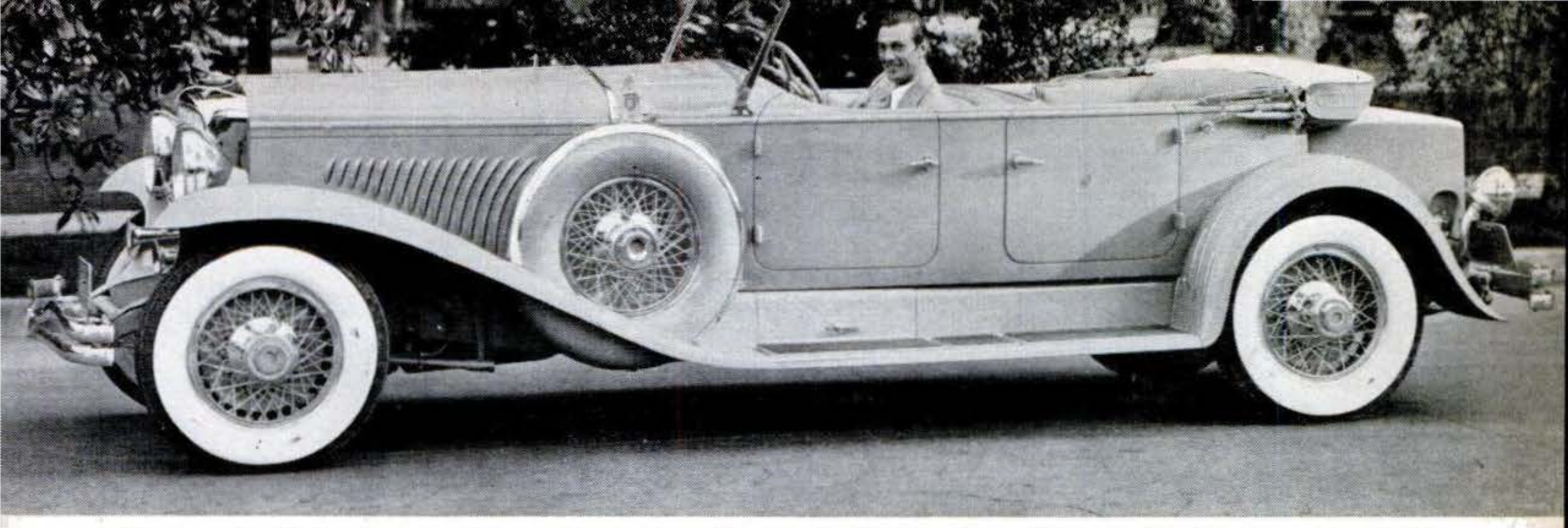


Custom-built body on a Duesenberg chassis was built for Gary Cooper by Derhams in 1931.

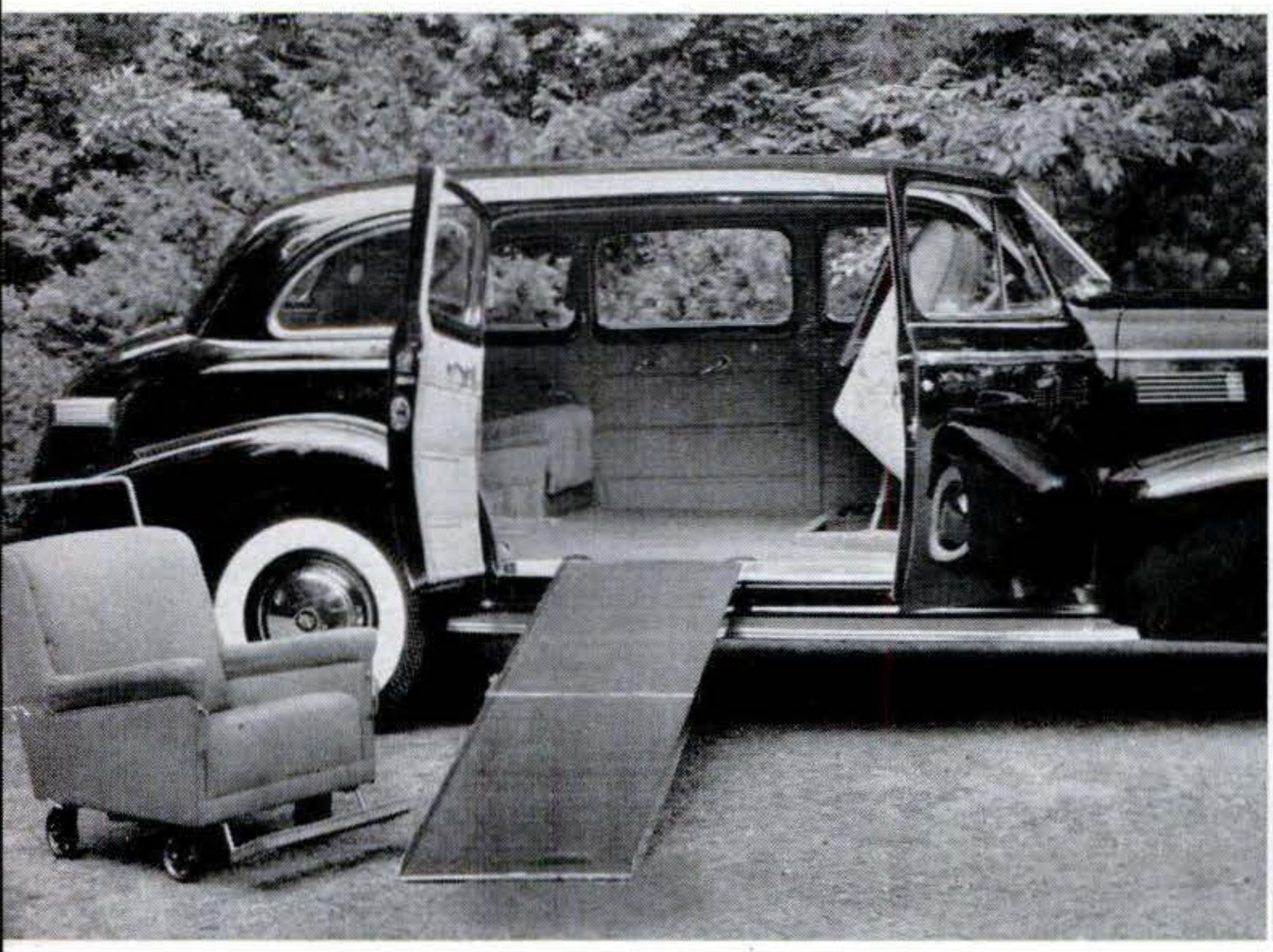
mor plating. Several Latin American officials are driving around in cars made "bullet-resistant" in Rosemont, Pa.

The Derhams use laminated Fiberglas, which is light and strong and won't call for extraordinary strengthening of springs, brakes, and even engine. But the material will no longer "resist" bullets if it is bent, so it is patched into place like mosaic. Heavy wire mesh protects the radiator and the engine. The most difficult part of the job is to make room for the 1⅛-inch-thick bulletproof glass. Doors, door frames and all window frames must be thickened to take the wider channels for the thicker glass. When finished, the car looks no different inside or out.

For people who miss the running boards on new cars, the Derhams build a retractable step that works hydraulically at the touch of a button. A spring-operated safety check rises when the step is out so the door can't be closed until the step is tucked back in.

Money No Obstacle

Each car turned out by the Derhams is distinct from the run of the mill. What is ordered has never surprised the Derhams, but they can't help being a little surprised now and then at the easy manner in which many orders are given. They tell of the president of a distillery who wanted a Chrysler chassis fitted with a body that had Lincoln Continental lines. He was considering gray or maroon as a body color when he was told the car would cost $19,000. "Oh," he said, "I'll take one of each color." END



In this special conversion for a wheel-chair invalid, the centerpost was removed and front seats hinged to allow room for maneuvering.

The de luxe wheel chair rolls up on a collapsible ramp, shown at left above. Chair is then locked in place to form part of rear seat.

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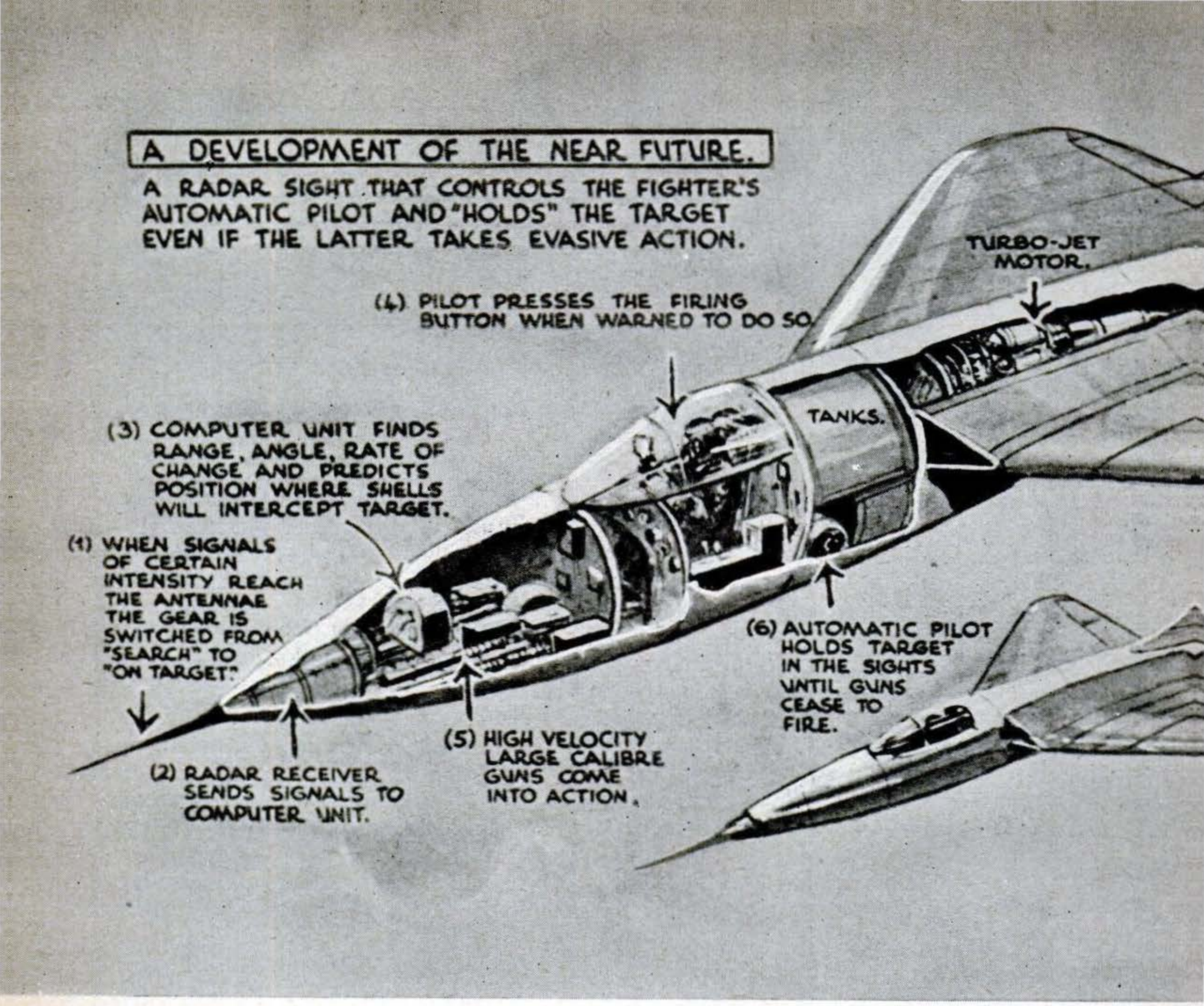

British Dream Fighter Flies and Fires by Radar

AT 500 m.p.h., a fighter pilot has only seconds to sight his guns, fire—and fly the plane at the same time. In this British interceptor of the future, radar would do it all for him—even fly the plane—he'd only have to press the trigger.

Radar would direct the plane to the target, as it already does in present fighters, but then it would go farther. It would automatically sight the guns, hold the plane on the target by interlocking with the automatic pilot, and then warn the pilot when

Ocean Tides Put the Bite on Pile-Eating Borers

TIDES do the work in the pile-creosoting device at left. The floating collar is filled with the protective liquid and coats the pile as the collar falls and rises with the tide. A film of creosote is wiped on and kills the pest where it does its damage between high and low water marks. It takes five minutes to put the collar on, and one 24-hour treatment lasts a year. It saves thousands of dollars a year in Sydney, Australia, where it was invented.

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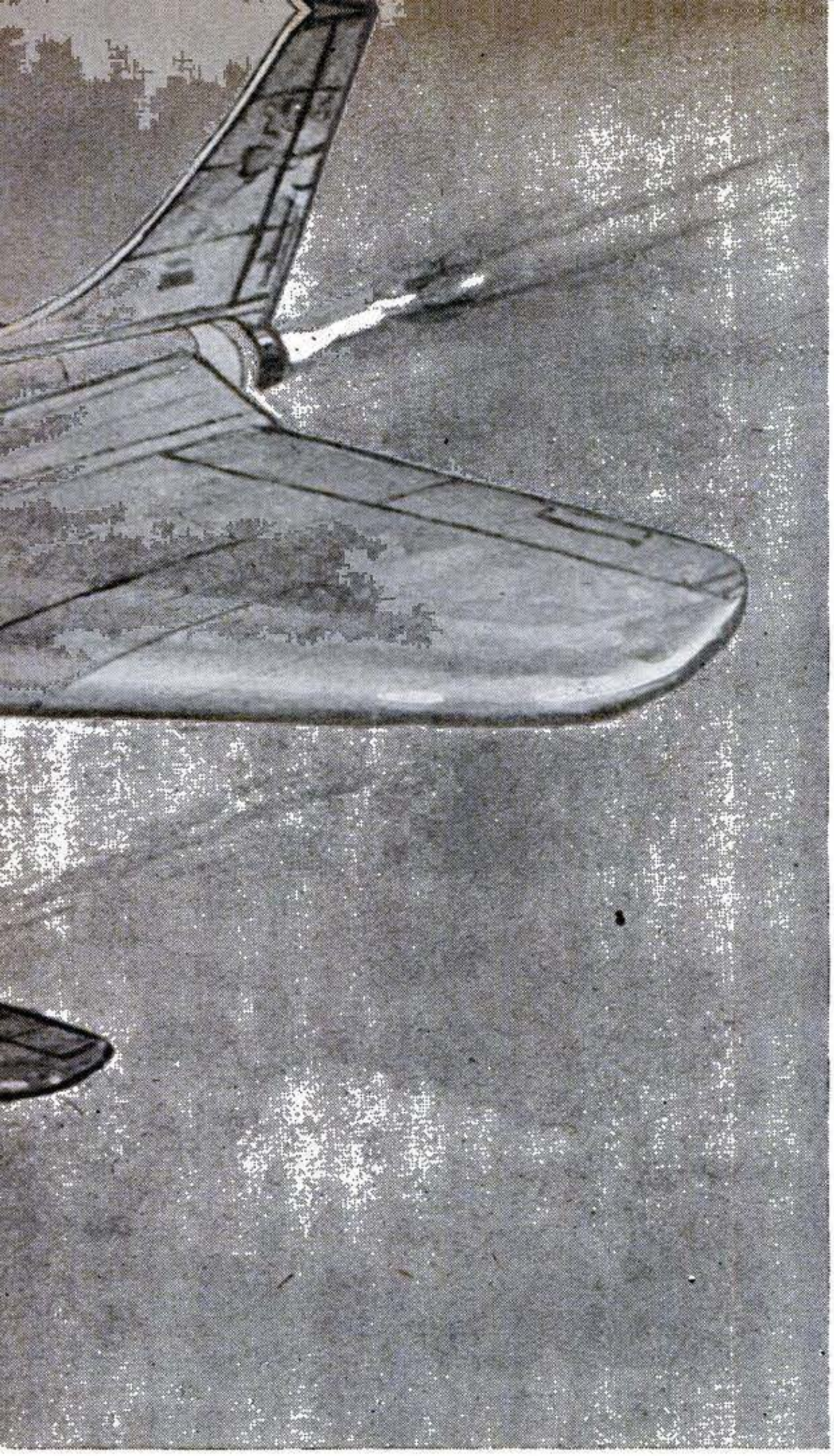


to fire. It would keep the plane on the target as long as the guns kept firing, then cut out and let the pilot take over. At 40,000 feet, where the skies above are dark even by day and planes are hard to see, these added radar eyes and hands would turn near-misses into sure hits.

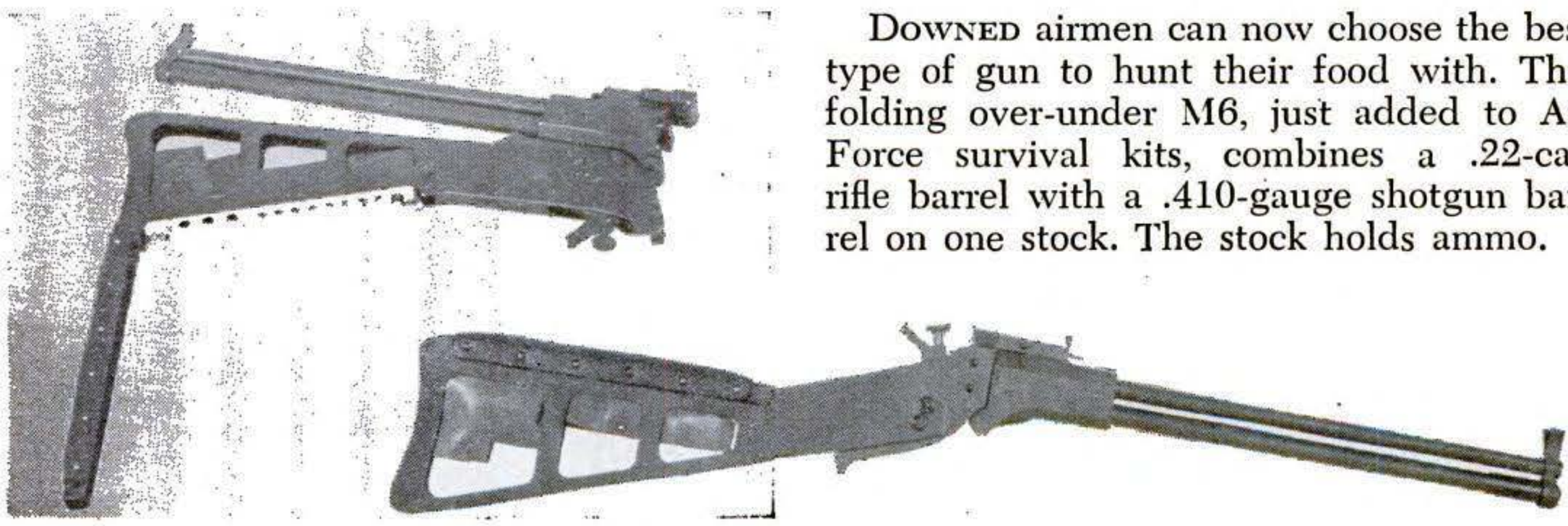
Tiny Detector Spots Hot Atoms

THE Navy's newest detector for atomic rays is the tiny two-pound Radiac, which measures the amount of radioactivity and buzzes an alarm. Teams going into contaminated areas sling it around their necks.

Chemical Copies Colored Pictures

WIPE Copy-It on a colored or black-and-white illustration in a pulp magazine or newspaper. Press an ash tray, greeting card, towel, or paper against the moist surface. The picture transfers in a few minutes. Kit Kraft, Los Angeles, sells it.

New Survival Gun Combines Rifle, Shotgun



DOWNED airmen can now choose the best type of gun to hunt their food with. This folding over-under M6, just added to Air Force survival kits, combines a .22-cal. rifle barrel with a .410-gauge shotgun barrel on one stock. The stock holds ammo.

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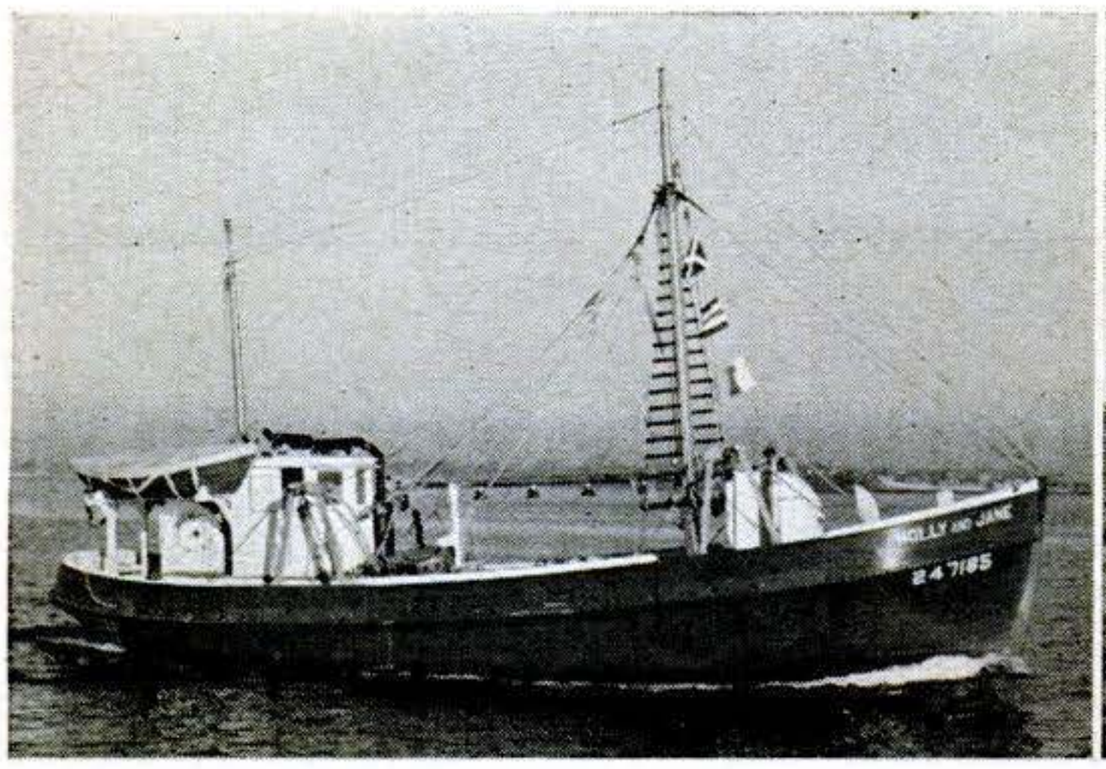
Can You Name Fishing Boats?

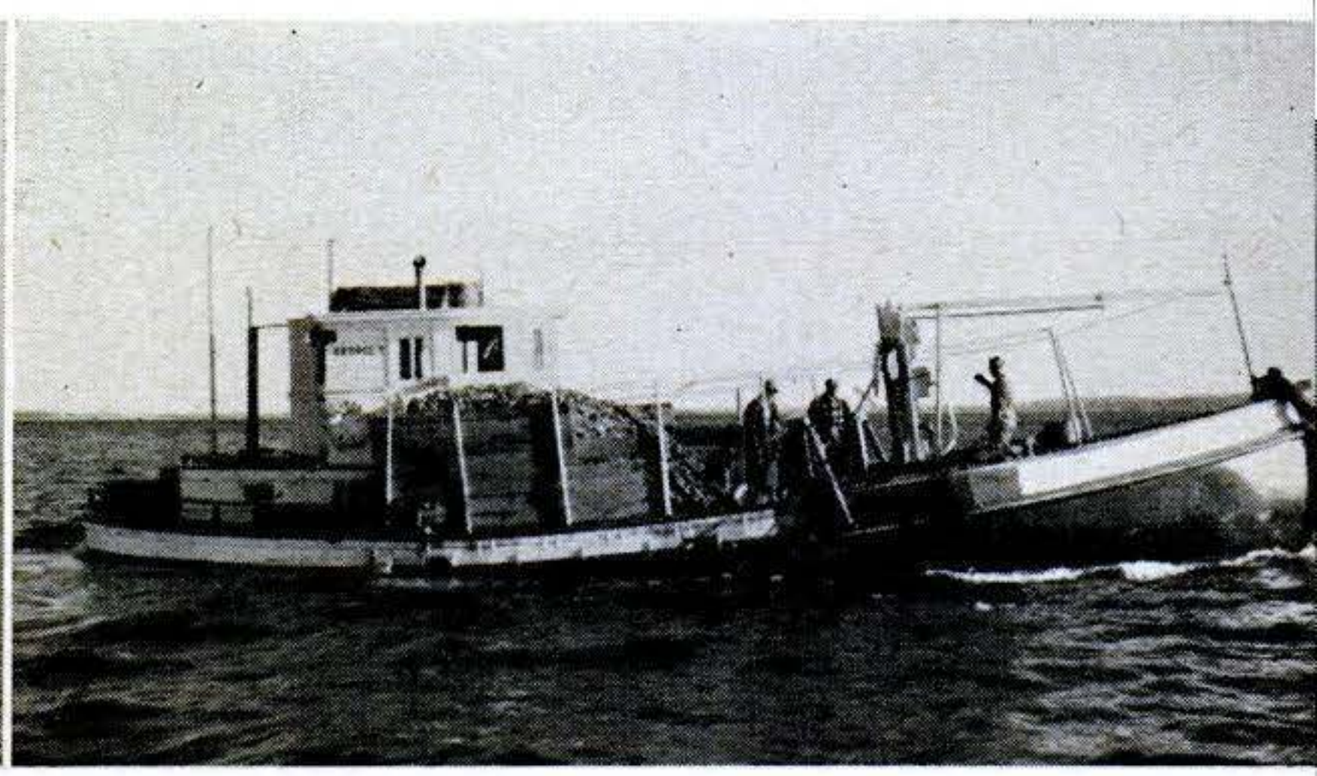
HOW well do you know fishing boats? An expert can tell, practically at a glance, where a vessel hails from and just what it's fishing for. Some of the boats operate in shallow sheltered waters, some on the rough open seas. Some go out for half a day, some for weeks at a time. And each boat is built accordingly.

The best known fishing grounds are the Grand Banks off Newfoundland, but the 10 commercial boats on these pages include types that operate in many other coastal and inland waters. You'll find guessing their names no easy job. Try it before you read the captions.

Two-masted sailing vessel, cut-down version of famous Grand Banks schooners, still serves as dory fisher in Nova Scotia.



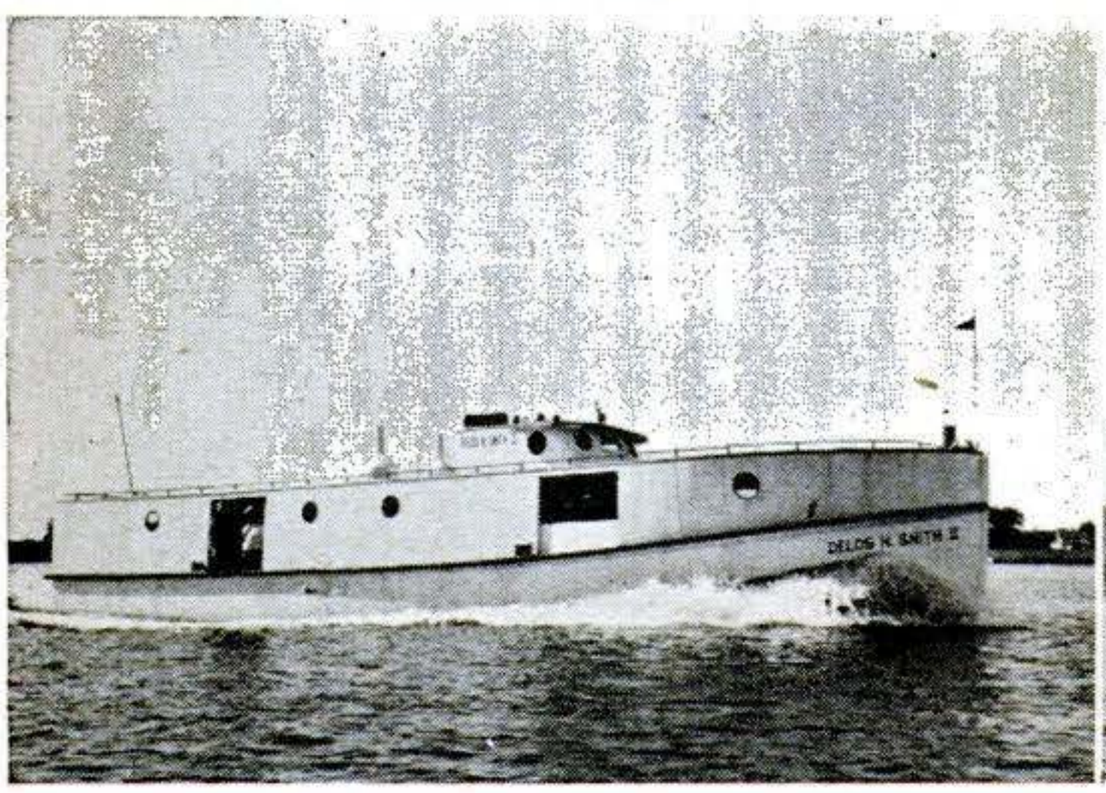
Commonest type has broad open space between foremast and deckhouse for dumping catch before storing it in hold. It's a trawler and can be spotted anywhere along our coastline.



Low freeboard indicates this vessel operates in quiet, sheltered waters. Heaped in the center are oysters scooped from Peconic Bay by a typical Long Island oyster dredge.

Completely enclosed deck protects fishermen while they set and haul in gill nets on this boat's fishing grounds, where weather is notoriously bad. It's a Great Lakes fish tug.

This giant of the fishing industry is only likely to be seen far out at sea. It's a 2,600-ton French trawler that makes two trips a year to Grand Banks to catch, clean and salt cod.



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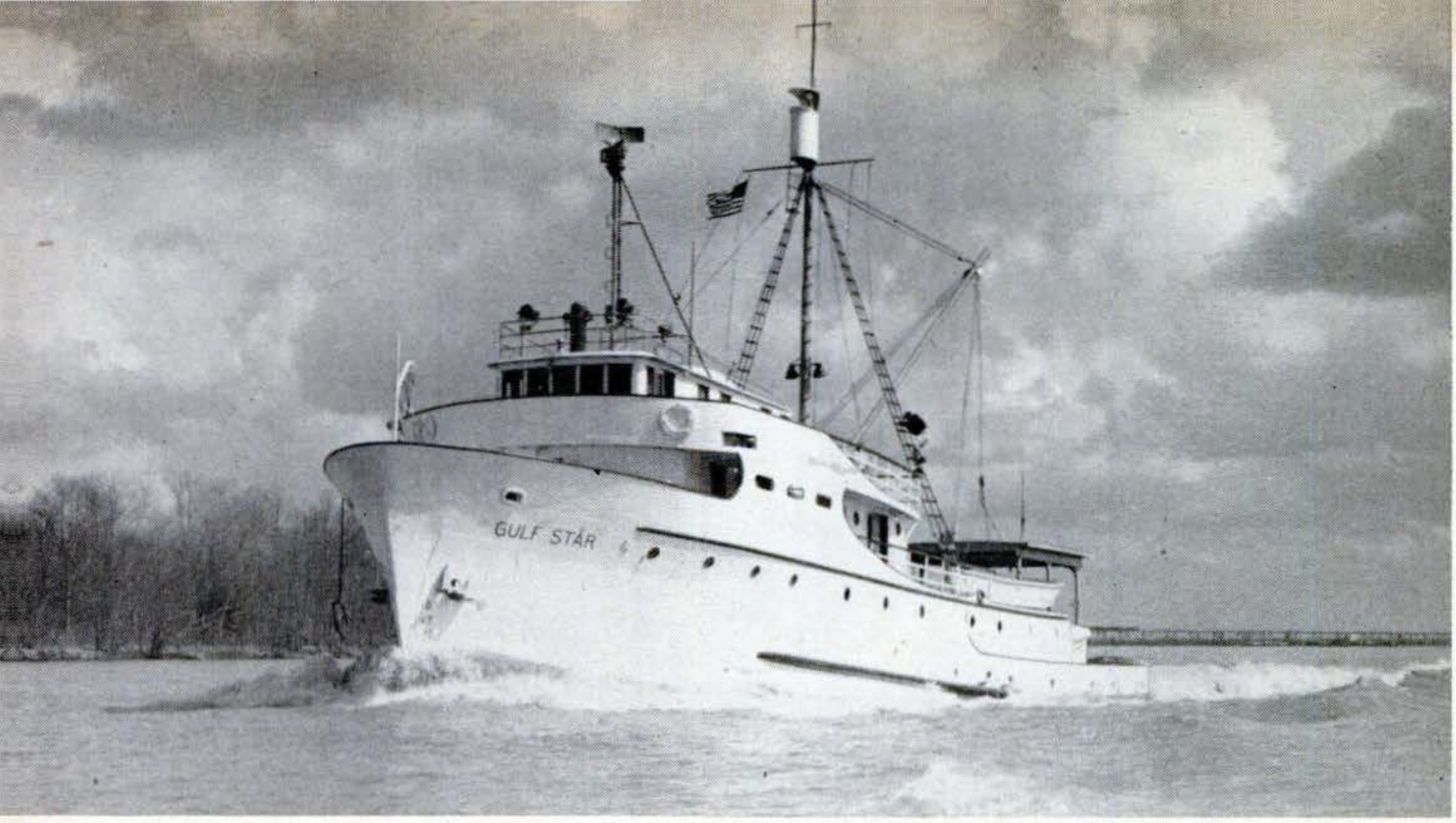
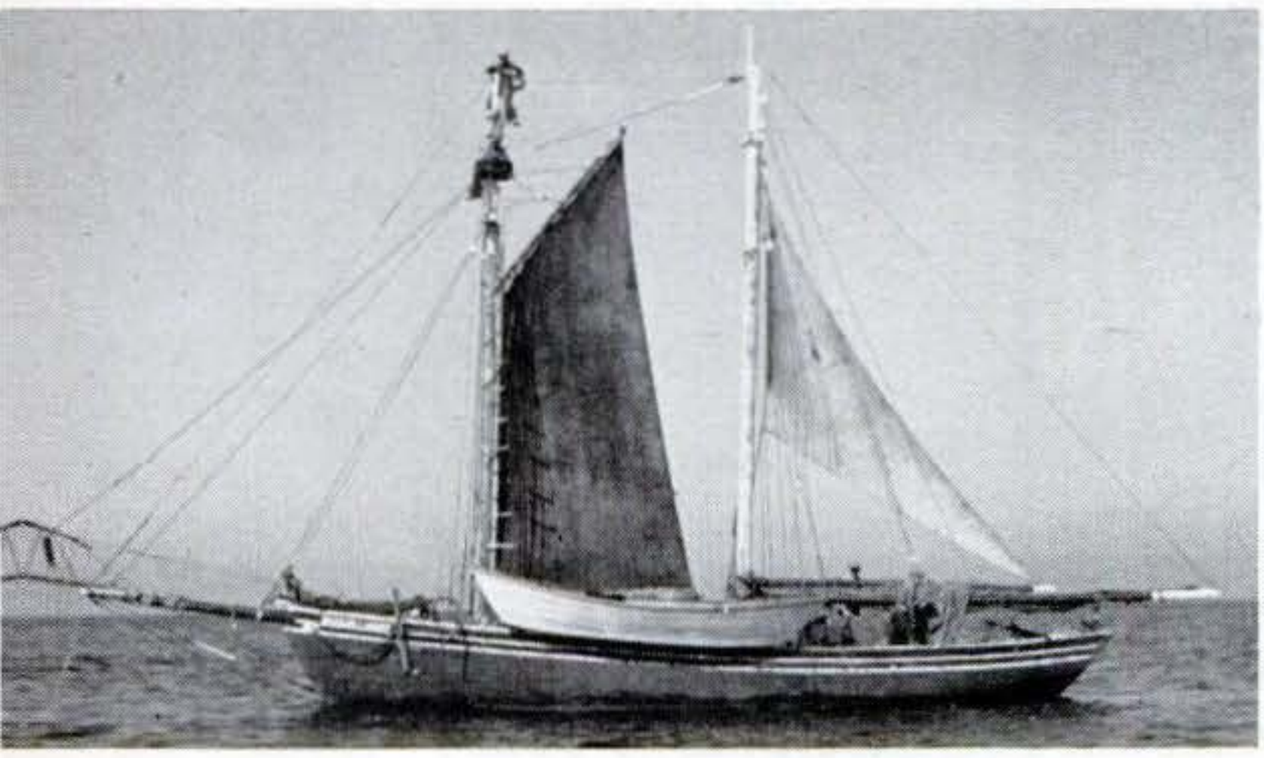
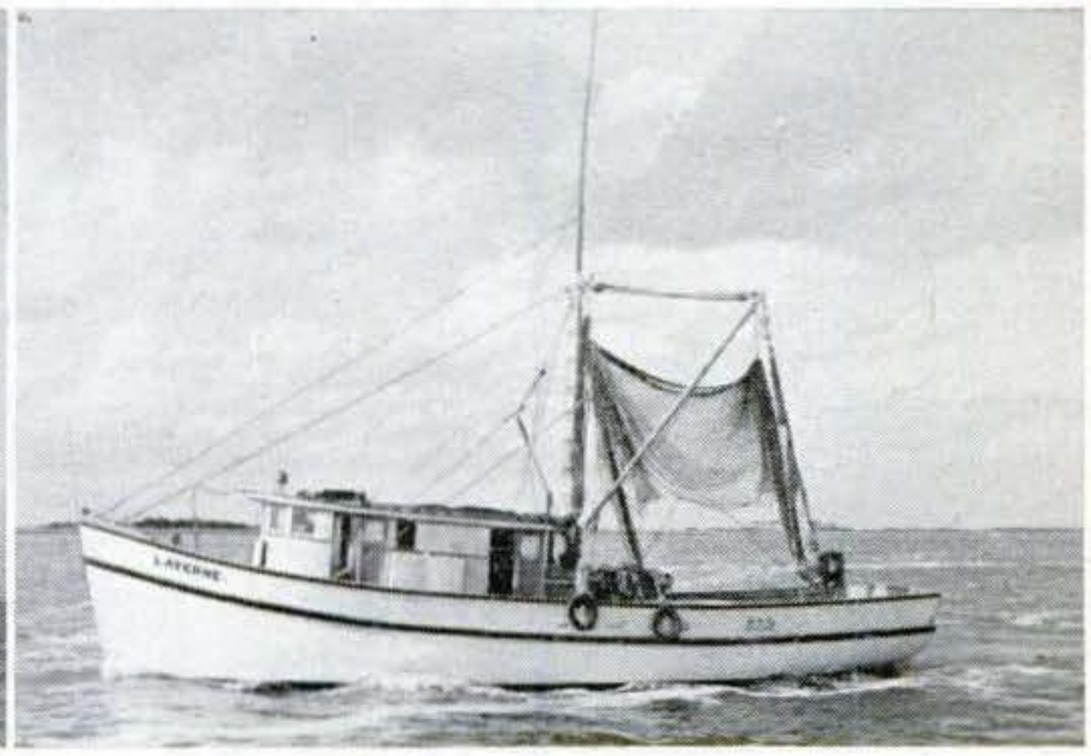


Streamlining, radar and the triple-level deck of this handsome vessel help identify it as one of modern Pacific Coast tuna clippers. The boats make 3,000-mile trips to catch tuna. Three men man a huge triple rod and reel. Less often, a purse seine is used.



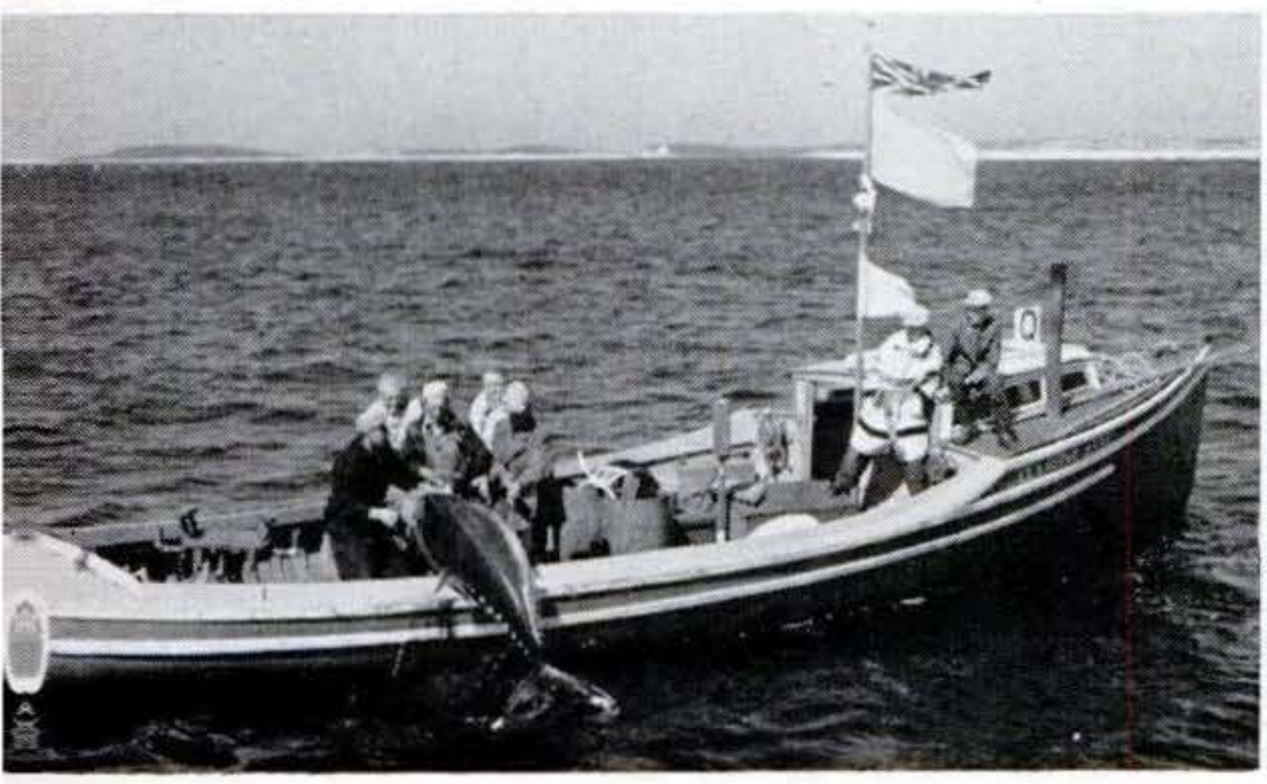
Seat for a spotter high up on mast, harpooner's pulpit on the end of the bowsprit, and outriggers are easy clues to this one. It's a swordfisherman and hails from Nova Scotia.

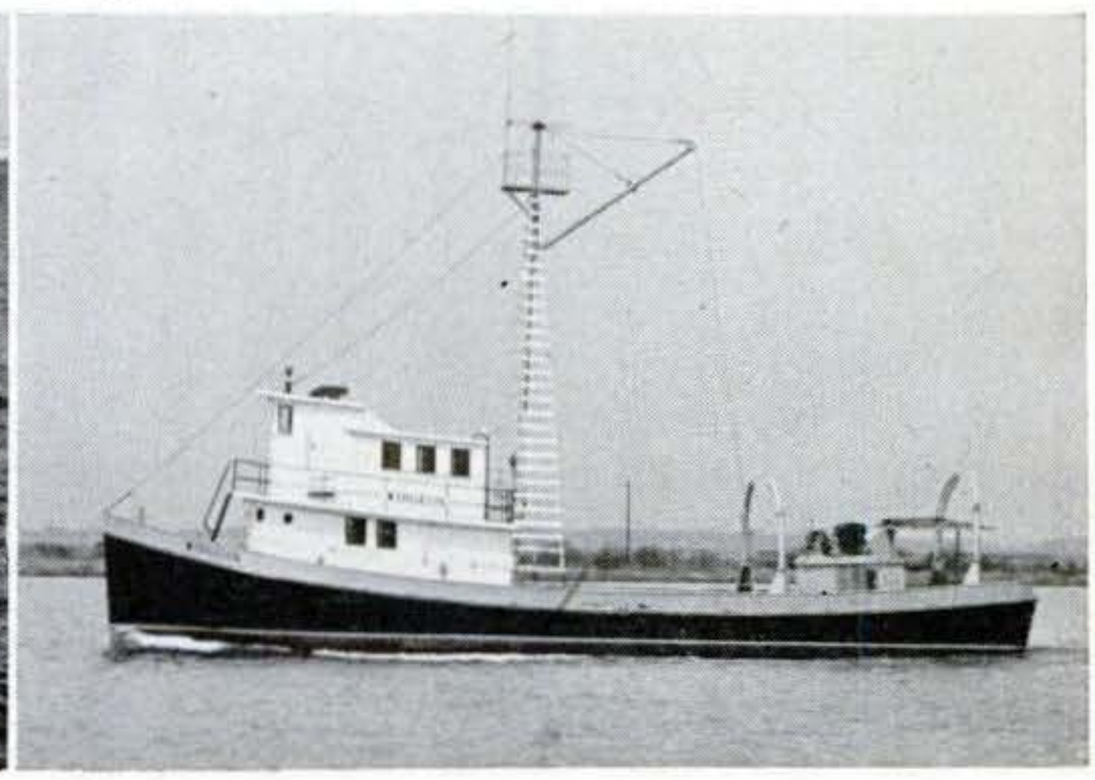


Raised net and forward deckhouse tag this one as a typical Gulf shrimper. The powerful winch mounted on the afterdeck is used for hauling up the heavily loaded nets.

The horse mackerel getting an assist over the bow into the broad cockpit gives this one away. It's a Cape Breton Island tuna launch used to catch giant bluefish tuna.

A very large deckhouse, tall mast with derrick, and location of all machinery aft are marks of a steel menhaden purse-seiner operating off the Virginia coast.





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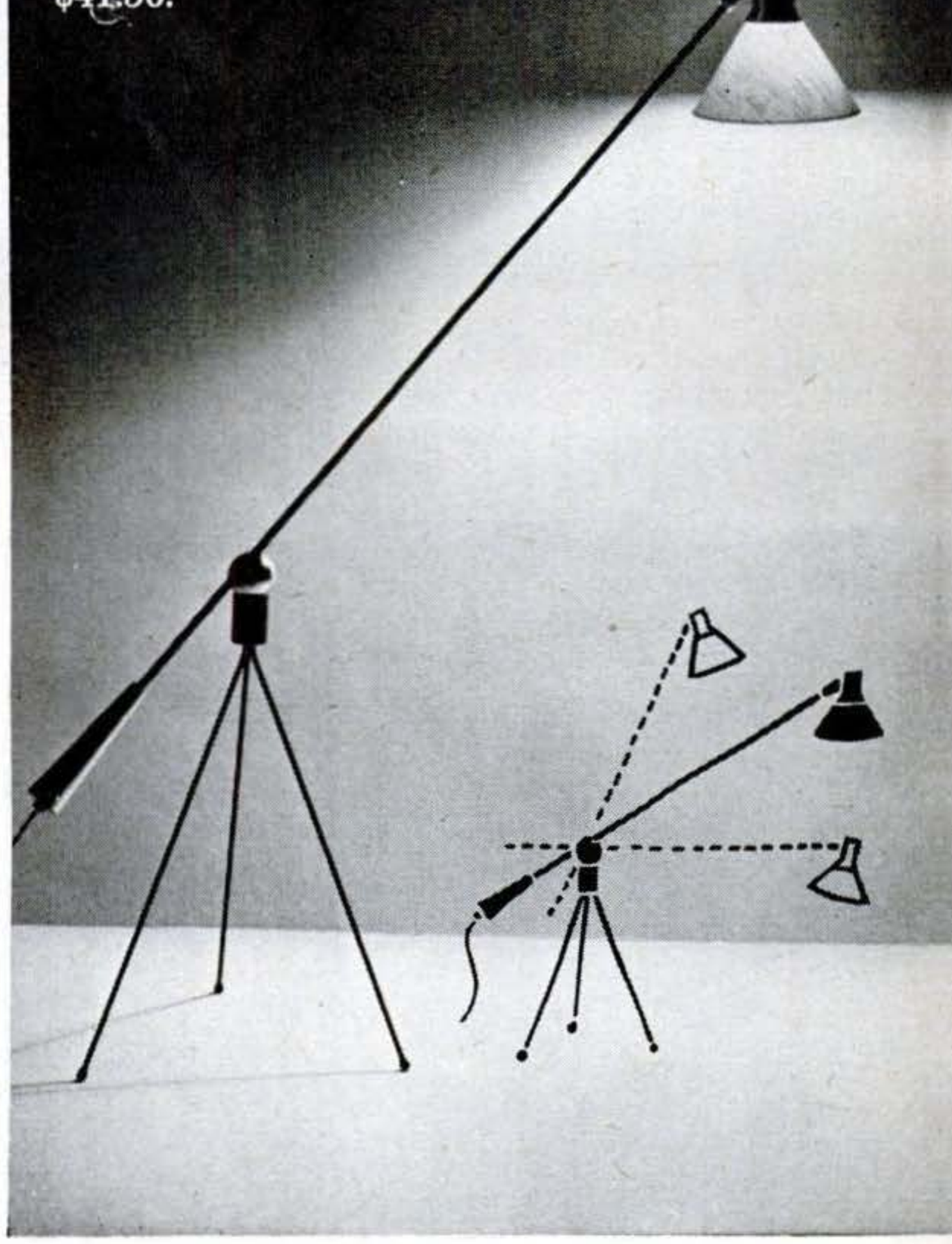
Prize Lamps Crouch, Crane and Straddle

Neither flying saucers nor wire sculpture, these are the latest thing in lamps. Winners in a contest run by New York's Museum of Modern Art for lamps to match modern interiors, they are now being made commercially by the Heifetz Co. Here Hubert Luckett has photographed each with its light pattern. Small drawings show how they work.

Coolie-hat reflector directs light thrown up by bulb gripped by tripod legs in floor lamp designed by A. W. and M. Geller, New York. It won honorable mention, now sells for $51.50.

No visitor from Mars, this table lamp stands on cork feet of three steel rods. Reflector hangs on rod tips. Pulling a rod through body, which holds bulb, tilts lamp. J. H. Crate, young GM designer, won $250 third prize with lamp. Price: $31.50.

Giraffe-like floor lamp won special $500 prize. Ball on counterweighted arm is held to socket on tripod base by magnet. Arm can be set in any position, and head swivels. Designed by Californian G. A. Watrous, lamp sells for $41.50.



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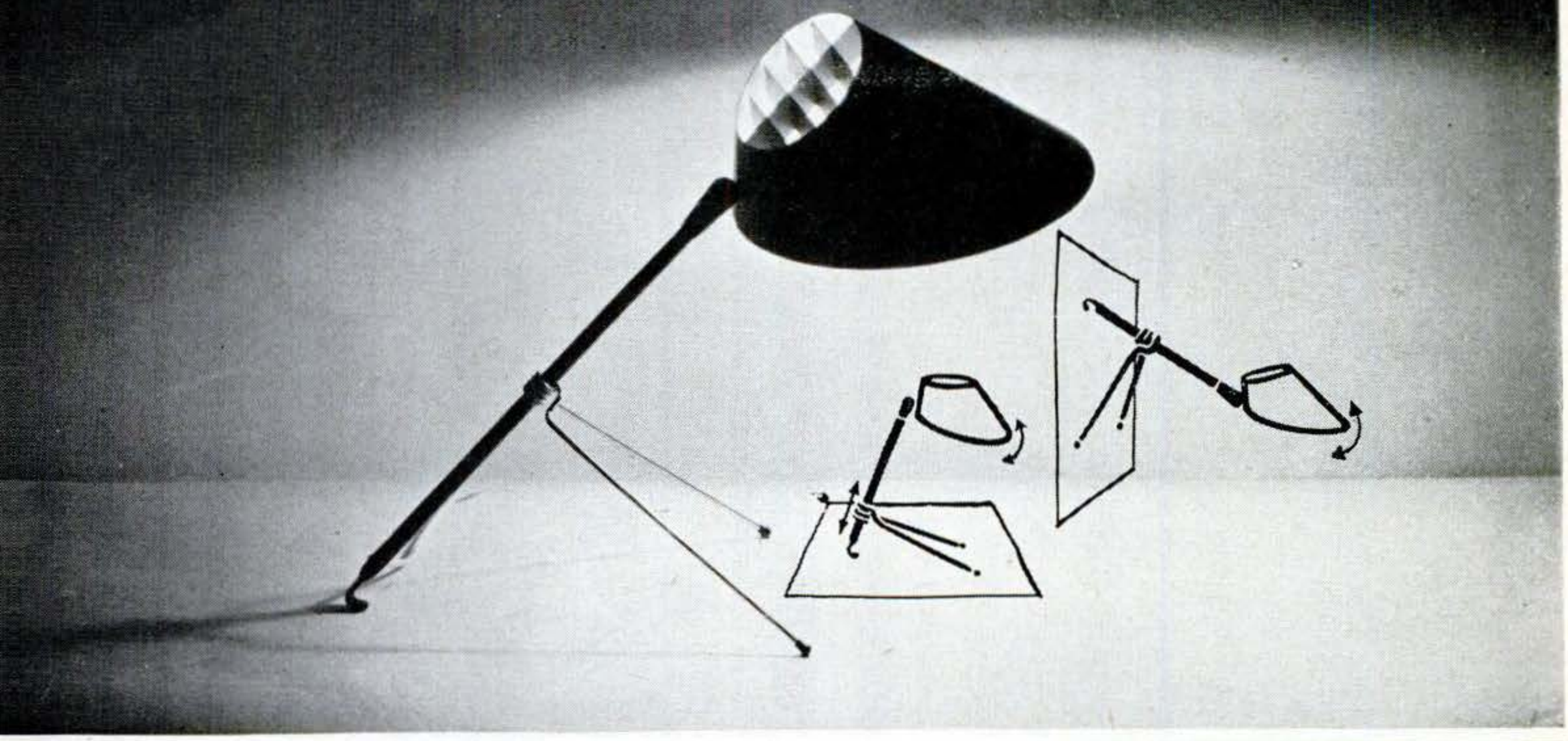
Crouching like alert Scottie, this table lamp won $500 second prize for A. Ingolia, Chicago student. Legs grip stem with spring, can be moved along it to alter tilt. Baffles behind shade ventilate it without glare. Lamp can be hung from shelf, pinned to wall. It sells for $23.50.



Winner of first prize—$1,000—was this straddle-shade design by J. Burnett, Chicago student. Two parts don't even touch. Bulb unit sits on table, throws light up against underside of shallow paper cone silvered on bottom and black on top. Moving bulb unit to one side or other of cone tip throws light in that direction; placing bulb right under tip scatters light evenly. Small holes in cone diffuse some light upward. Lamp sells for $37.50.

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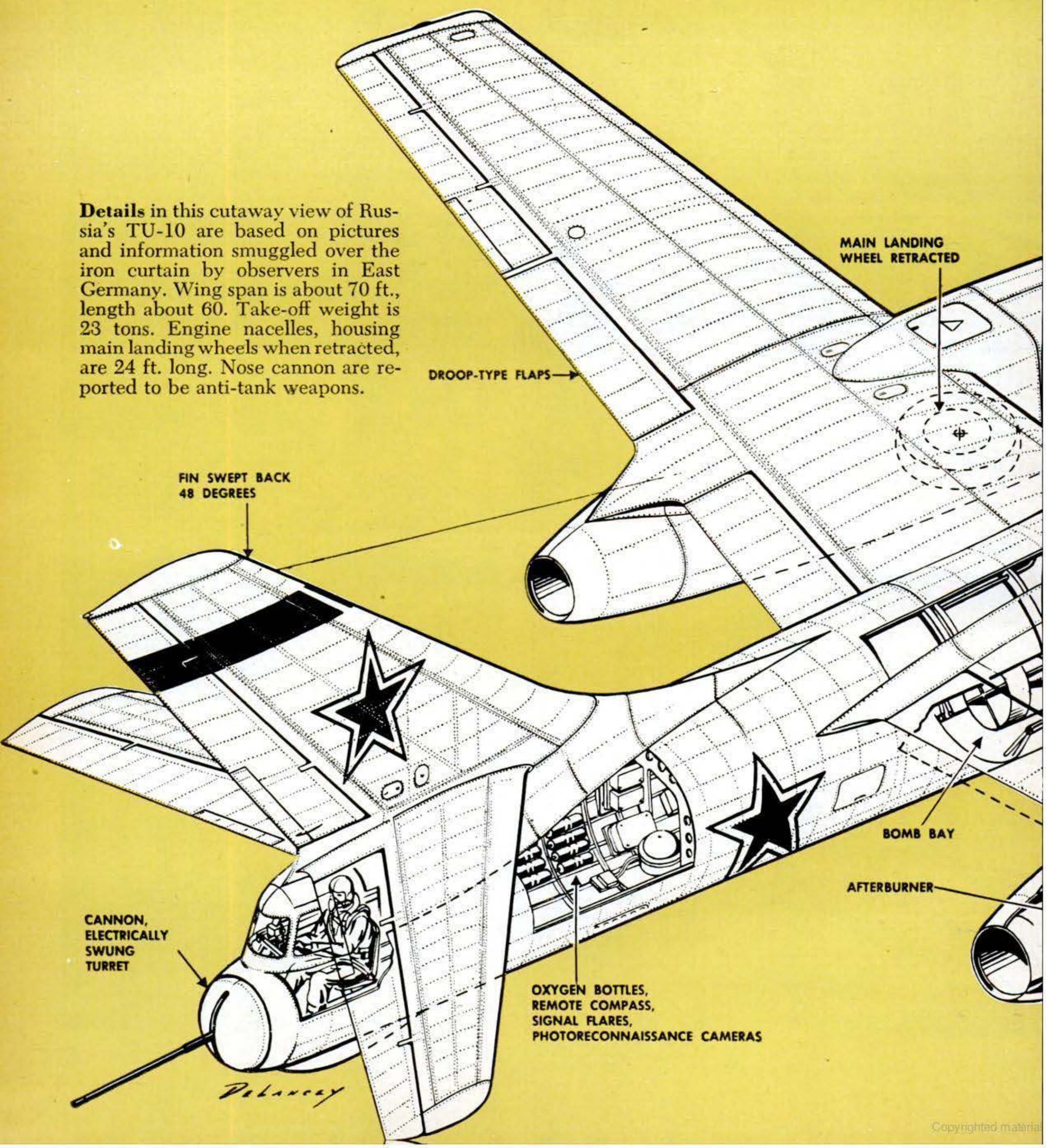
Russia's New 2-Jet Bomber

By Chalmers ("Slick") Goodlin
Noted Test Pilot

RUSSIANS in Eastern Europe are flying a fleet of brand-new, hot bombers. They were made for the express purpose of running interference for the Red infantry.

Powered by twin jet engines, the new plane is bigger, far faster and harder hitting than the propeller-driven Stormoviks with which the Red Air Force helped turn back Hitler's Panzer divisions. The Russians call it the TU-10.

Two items of the TU-10's equipment make it stand out. One is apparently the first Russian production version of a compact navigational-search radar installation.



Details in this cutaway view of Russia's TU-10 are based on pictures and information smuggled over the iron curtain by observers in East Germany. Wing span is about 70 ft., length about 60. Take-off weight is 23 tons. Engine nacelles, housing main landing wheels when retracted, are 24 ft. long. Nose cannon are reported to be anti-tank weapons.

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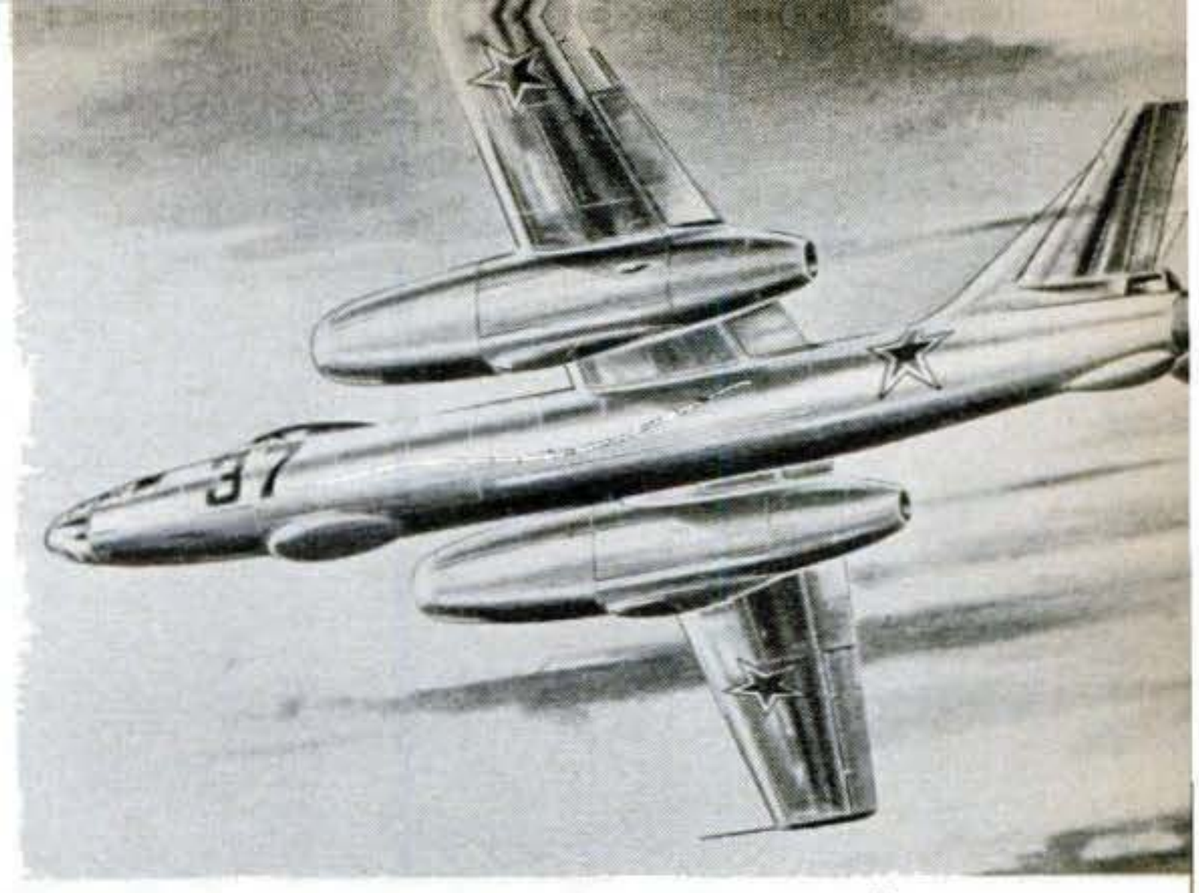
The other is a new jet engine, the M-018. It develops 7,700 pounds of thrust and has an afterburner for extra bursts of power. By way of comparison, the U. S. B-45 has jet engines of only 5,200 pounds of thrust but uses four compared with the Red Air Force bomber's two.

The TU-10 is manned by a crew of three —a pilot, a bombardier-radar operator and a crew chief who doubles as tail gunner. It compares closely in size and performance with the British-developed Canberra, which is being adopted by the U. S. Air Force but is not yet in production. END



New Red attack plane hits 580 m.p.h.

PILOT

BOMBARDIER-RADAR OPERATOR

TARGET-RECORDING CAMERA

FUSELAGE FUEL CELLS

BOMBSIGHT

TWO CANNON

RADAR DOME

FUEL CELLS

AXIAL-FLOW JET ENGINE

HOT-AIR DE-ICING TUBES

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This Bus Rolls Through the Sky

Mount Hood in Oregon gets longest passenger-carrying aerial tramway.

By Richard L. Neuberger

IT WAS a great day when the first bus arrived at Timberline Lodge, halfway up Mount Hood's icy slopes, in the autumn of 1937. This bus arrived as busses generally do—on the ground. It was an even greater day in the late spring of this year when a bus reached Timberline as busses only rarely do—through the air.

The vehicle was a twin-motor coach of 370 horsepower, like the ones that rumble over the asphalt of hundreds of American cities and towns. But this one had no contact with asphalt or any other road surface. It came in at treetop level like a hedge-hopping airplane and deposited 36 enthusiastic passengers on a wooden platform far above the snow.

This most extraordinary of busses now leaves every hour on the hour for the partial ascent of the highest mountain in rugged Oregon. It climbs from the 3,800-foot notch on the south side of Mount Hood to the 6,000-foot elevation of famous Timberline Lodge. The terminal is 53 miles east of Portland, on State Highway No. 50.

Riding cables suspended from 40 deeply anchored steel towers, the cloud-scraping sky coach swings up the mountain for 3.1

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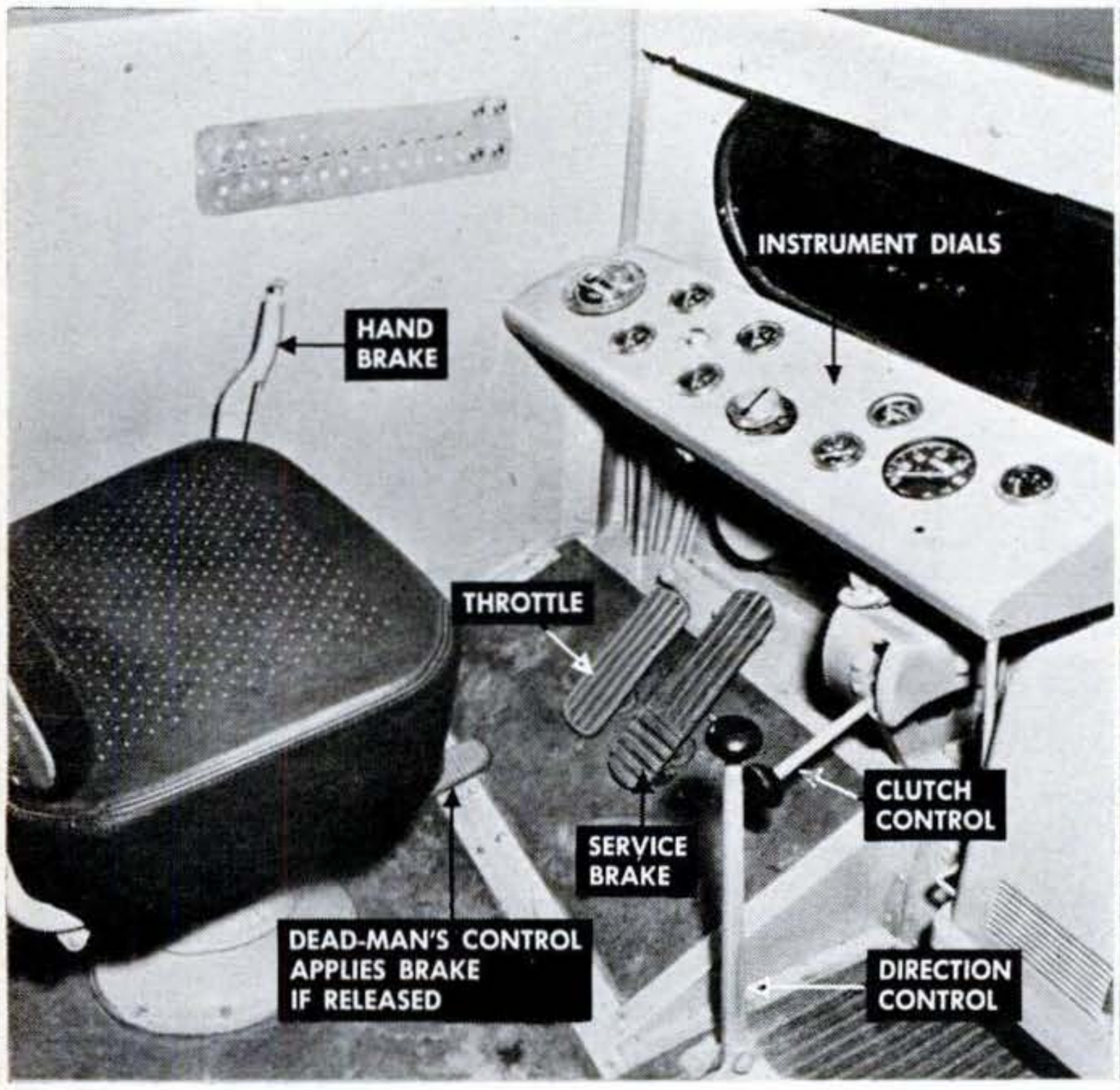
Aerial bus, seen in mid-air on opposite page, starts ascent from roadside terminal above.



Driver uses these controls to maneuver the sky-riding bus. Part of driving that calls for most skill is getting car over cables' supporting "jacks" without excessive jolting.

Passengers have magnificent aerial view of scenery as 36-passenger bus rides up and down the slopes of Mt. Hood on cables stretched between A-shaped towers 50 to 600 feet apart.

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miles. This makes it the longest passenger-carrying aerial tramway ever built. The car gains more than 700 feet in altitude for each mile traveled. It takes 24 minutes to make the uphill journey with a full load. Running time on the descent is 16 minutes.

Unlike nearly all other aerial tramways, the one on Mount Hood has stationary cables. They never move. Nor is there any power equipment at the terminals. All the tractive effort is contained in the bus, which literally hoists itself along the heavy lines by means of traction cables below and parallel to the weight-supporting cables.

On each side of the bus, a traction cable passes in turn over an idler pulley; around the front "wheel," which is actually a power-driven pulley; around a similar rear "wheel"; and over another idler pulley, which unreels the traction cable at the rear as fast as it is reeled in at the front. When flat pancake-type motors at the bottom of the bus get busy, the car rumbles up the cables to Timberline.

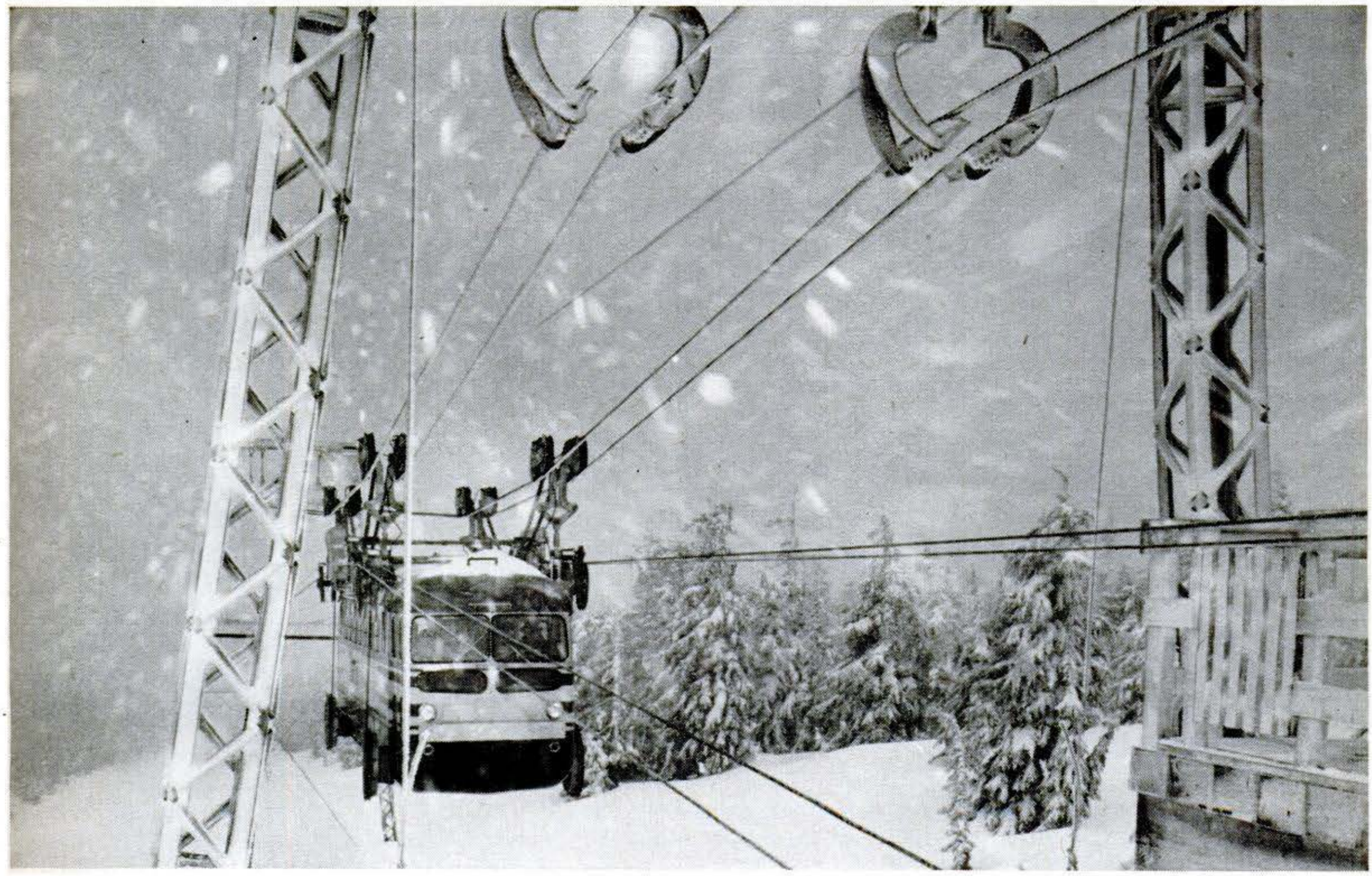
Because these coaches are so much like the bus that hauls you through town and city streets, a ride on the Mount Hood tramway is all the more a novel experience. You glance out the window expecting a bus rider's customary view of store fronts. Instead, you look at treetops or thin air. In many places the coach sways 70 feet above the ground. There are no truly dizzy gaps below, such as at Sugar Loaf Mountain in Rio de Janeiro, in Brazil, for the Mount Hood "cloud liner" parallels the general contour of the earth. But the panorama from its leather seats makes the pulse throb faster. And that is the main reason why $750,000 has been invested in building the project. It is essentially a scenic venture.

Tourist Gets 150-Mile Aerial View

On the twisting gravel automobile road to Timberline, the majestic view was obscured by foliage and switchbacks. Now the tourist who has paid $1.50 for his round trip on the tramway can gaze out across the picturesque face of Oregon for nearly 150 miles. Not a wisp of vegetation interferes with his vision.

Out of the green sea of fir and pine timber, the extinct volcanoes of the Cascade Range loom like white frigates. Mount Jefferson is a snowy mainsail that seems close enough to touch with an alpenstock. And

Aerial bus swoops on fixed cables, supported at each of the steel towers by "jack" seen at top of the picture below. In many places, vehicle soars 70 feet above the ground.



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Upper terminal of 3.1-mile sky ride is at the 6,000-foot level of Timberline Lodge, halfway up Mt. Hood, Oregon's highest peak. In making climb, the car gains 2,200 feet of altitude.

there, far off to the west, is the blue streak of the Columbia River. On the eastern horizon a desert of sagebrush chokes off the lush forests. This line of demarcation is as sharp as a moat. For camera fans, each passing foot of elevation on Mount Hood's steep ramparts unfolds a new vista.

Winter Interrupted Work

It took almost two years to root the 40 towers to the windswept apron of the 11,245-foot mountain. Men could work only from May until October because ice and snow reign on Hood the rest of the year. No road or trail offered access along the 3.1-mile route of the tramway. A series of steep ruts for trucks and "cats" had to be bulldozed before sacks of cement and sand could be dragged up the mountainside for the massive foundations on which the A-shaped towers would rest.

Terrain decided both the height and number of towers. Some are 40 feet high, others 72 feet. A few towers are only 50 feet apart, but many are separated by 600 feet of swinging cable. The concrete abutments, in which the uprights have been rooted, are 16 feet deep. The towers stretch up the slope like a centipede of steel.

Two Busses Needed in Busy Season

Two motor busses provide the mobile equipment. Usually the second coach is operated only on week ends or at the peak of the ski season. Both must head in the same direction, for there is only one sky "track." They can't pass each other. The two busses must be at least 10 towers apart to avoid undesirable tension on the cable.

Is the route dangerous? The maximum incline slants at 28 percent. A few passengers have uneasy moments when they look

Skiers alight after ascent. Bus climbs under own power by reeling in traction cables at front and unreeling them in rear. Idler pulley, top, guides cable to power pulley below.

down and wonder what would happen if the law of gravity suddenly went into unrestricted operation. But each bus is fitted with a complete set of air brakes. These clamp tightly on the wheels with brake bands almost an inch thick. If a leak or line break should cause the pressure in the

[*Continued on page 212*]

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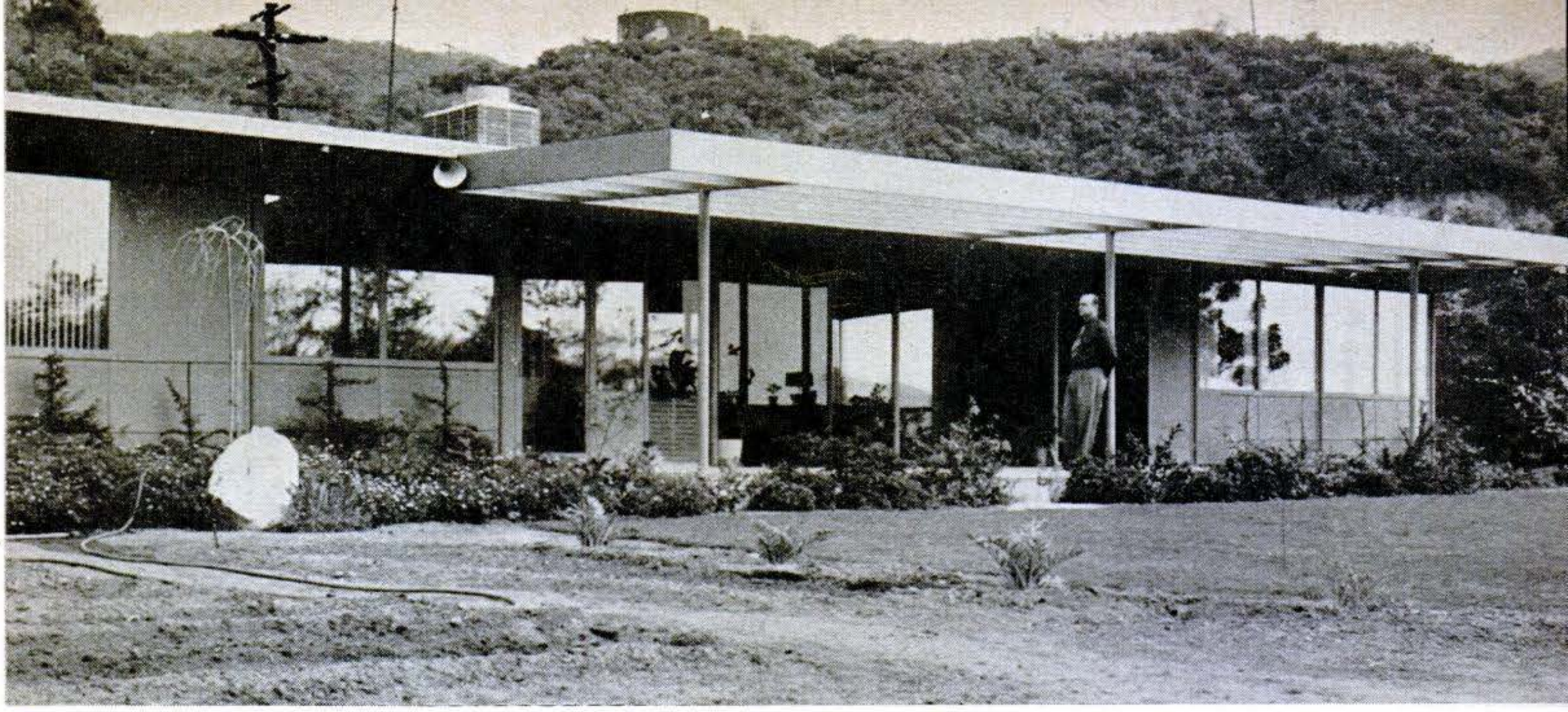


Twenty-eight flagpoles—ordinary three-inch iron pipe—support this house at Glendale, Calif. The walls are 4- by 8-foot Cemesto-board panels clipped to light-steel Ls and Ts and sealed in with wood strips and calking. Only other wood in house is in doors, shelves, cabinets. Roof decking in such houses can be either ribbed-steel panels or Cemesto board.

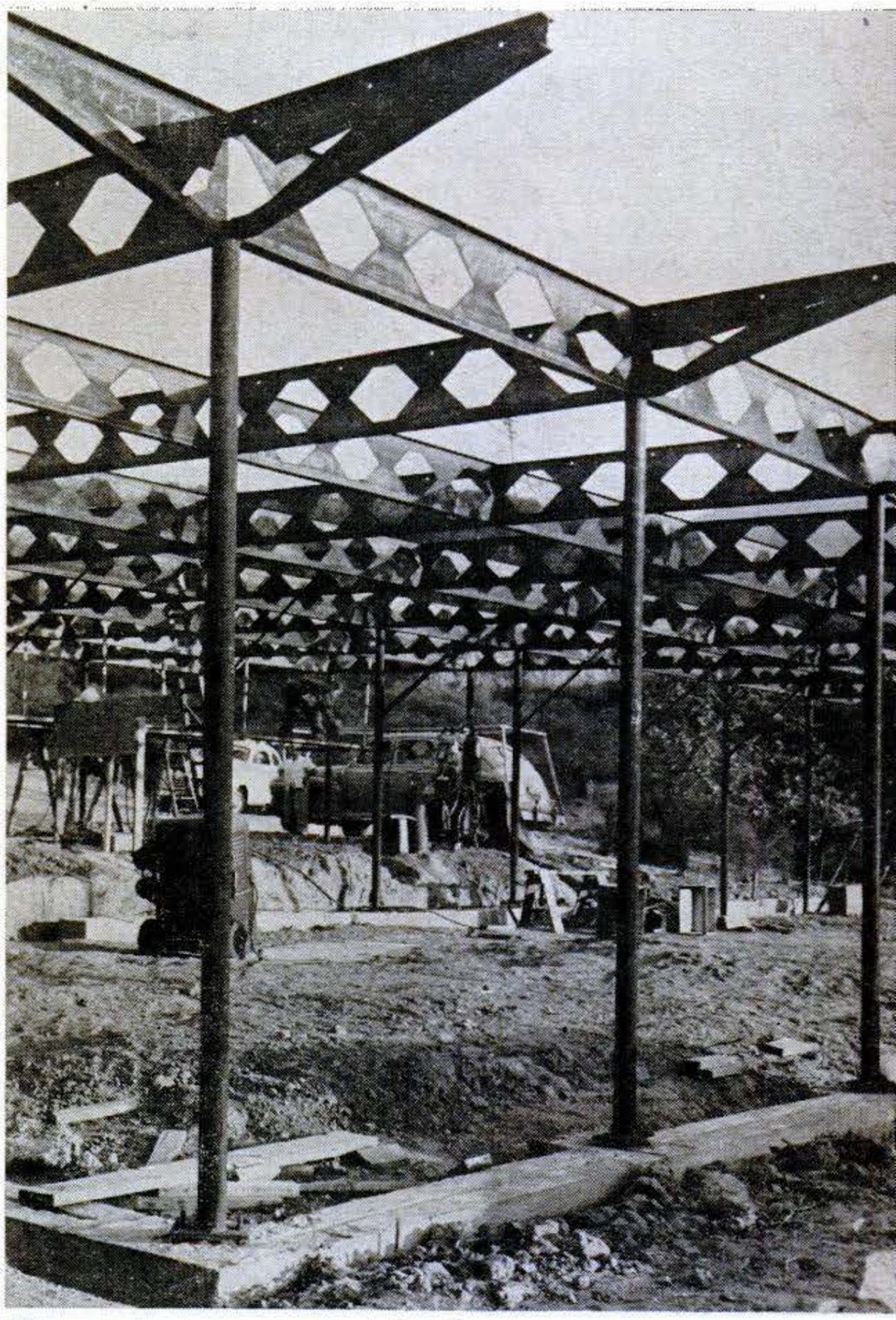
Easy-to-Alter House Sits on Flagpoles

NO PIPE DREAM, the ultramodern house above is nevertheless hung on pipes—the ordinary three-inch black kind used for flagpoles. It's said to be strong enough to last 250 years and stand a 150-m.p.h. gale. And it can be easily expanded or altered, inside or out.

The pipes, fixed in the concrete foundation, are the columns that carry the whole weight of the house. The eight-foot-square opening between each pair is filled with two four-by-eight panels. These are clipped to stud bolts in a frame of steel Ls and Ts. Panels can be solid, or doors or windows. The roof frame is a welded grid of steel beams and bridging.

Neither walls nor partitions are load-bearing, so the room arrangement and the wall openings can be easily changed. The house can be expanded in eight-foot multiples by setting new posts and welding on another section of roof frame.

Eugene Memmler, Pasadena graphic-arts instructor, conceived the new building method. He and Frederick Barienbrock, West Coast architect, developed the house.



Pipe columns every eight feet support open-web steel joists of roof. Angle iron will be welded to sides of pipes and across top and bottom of openings to hold wall panels.

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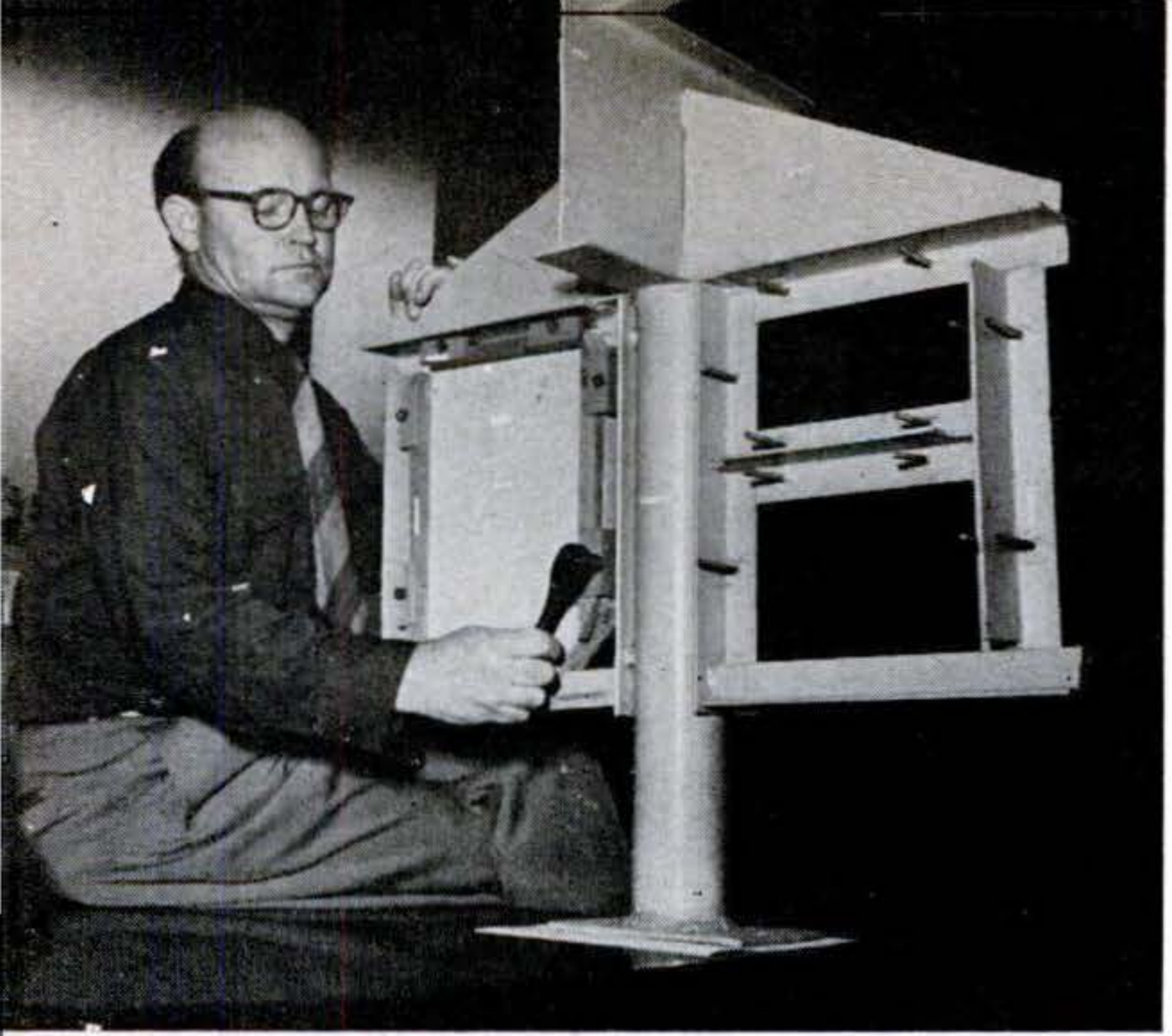


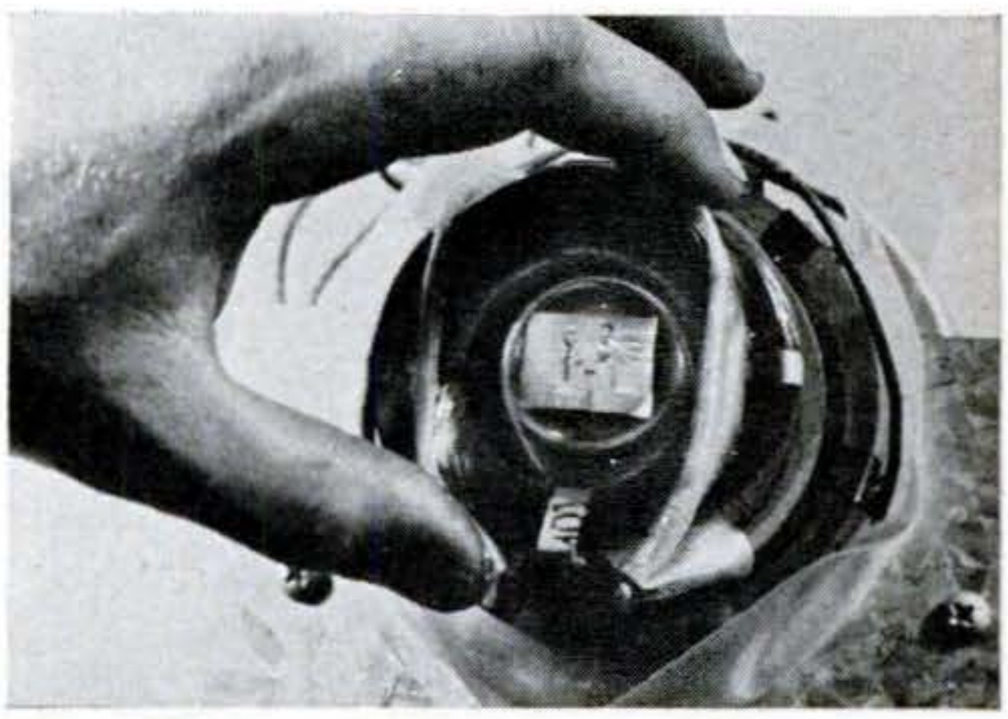
Model, shown with Eugene Memmler, who originated house, demonstrates how angle clips and stud bolts hold window and wall panels in place. Ratchet wrench is used to erect walls.

Glass-fiber ceiling panels, 2 feet by 4 feet, rest on flanges of I beams and Ts. They can be conveniently lifted out for painting or cleaning, or to reach pipes and wiring.

Electric outlets are wired through wall channels alongside pipe columns. Main wiring and water pipes run through open-web roof joists between the ceiling panels and the outer roof.

'Scope Camera Shoots Tiny Meteors

ASTRONOMERS can now photograph a meteor no bigger than a buckshot as it shoots across the night sky 50 times as fast as a rifle bullet. This new Super-Schmidt telescope-camera does the job. It is expected to catch 40 times as many meteors as present sky cameras, covering a tenth of the visible sky in one exposure. Acquired by Harvard, it uses two 18-inch lenses and a 23-inch concave mirror.



Tiny Picture Tube Tests TV Coils

THIS one-inch TV picture tube—said to be the world's smallest—is used by a television manufacturer to test coils that control picture size, focus and brightness. Ordinarily put around the necks of regular tubes, they now can be tested quickly by slipping them over the face of the miniature tube, avoiding disturbance to connections at the base. Du Mont, the designer, does not sell the tiny tubes.

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First color receiver, CBS-Columbia console, left, will also catch black-and-white telecasts.

Here Is What You'll Find

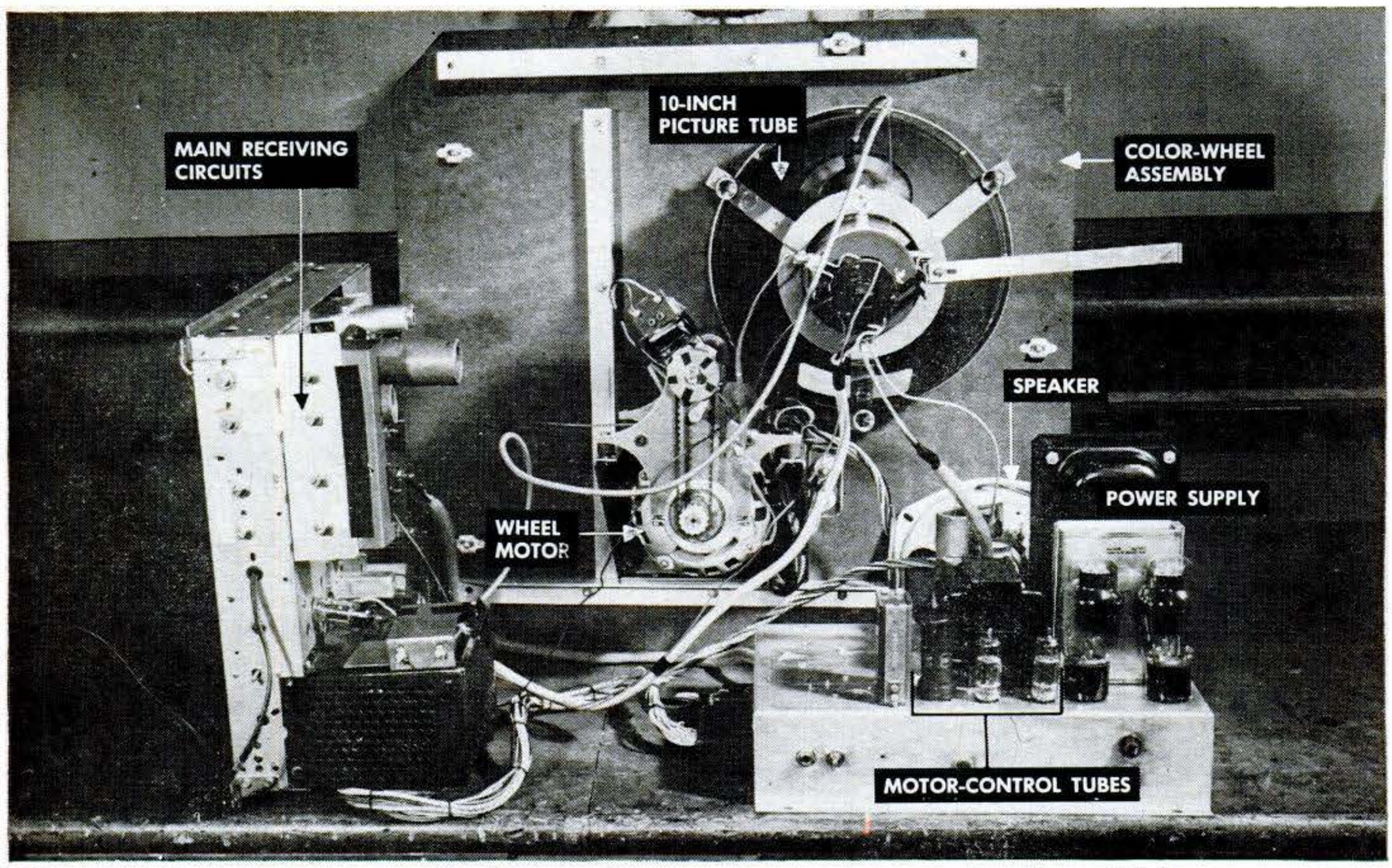
Inside the New Color TV Sets

By Robert Gorman

"COLOR receivers are simple and should be within the economic reach of the great mass of the purchasing public," declared the Federal Communications Commission when it okayed the Columbia Broadcasting System's proposals for color television.

One way to make a color receiver is to build onto a present black-and-white set. CBS colorcasts can be received in black-and-white on any set if an *adapter* is added to it. Colors can be seen by adding a *converter* with color wheel to an adapted set. Or a *slave unit* consisting of a separate picture tube and color wheel can be connected up to an ordinary TV set to bring in color pictures.

But manufacturers are rushing now to



Pilot model of the works inside the console at top of page. Chassis is little different from present receivers, but has added circuit to keep color wheel synchronized with transmitter.

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produce *combination sets* that will receive either colorcasts or black-and-white on the same screen. One of the first of these to be disclosed is the CBS-Columbia console (in some places also trade-named "Air King"), shown on this and the facing page. It is made by a subsidiary of the color-championing Columbia Broadcasting System.

How it works. When a color picture is televised in the studio, filters at the camera separate the picture's red, blue and green components. These individual color "fields" are transmitted as a rapid succession of black-and-white images. They are sent out at a rate of 144 a second.

To put this picture together in the receiver, a spinning color wheel passes over these black-and-white pictures at exactly the same rate. In Air King receivers, the wheel is driven by a motor that's linked to the wheel shaft with a toothed belt.

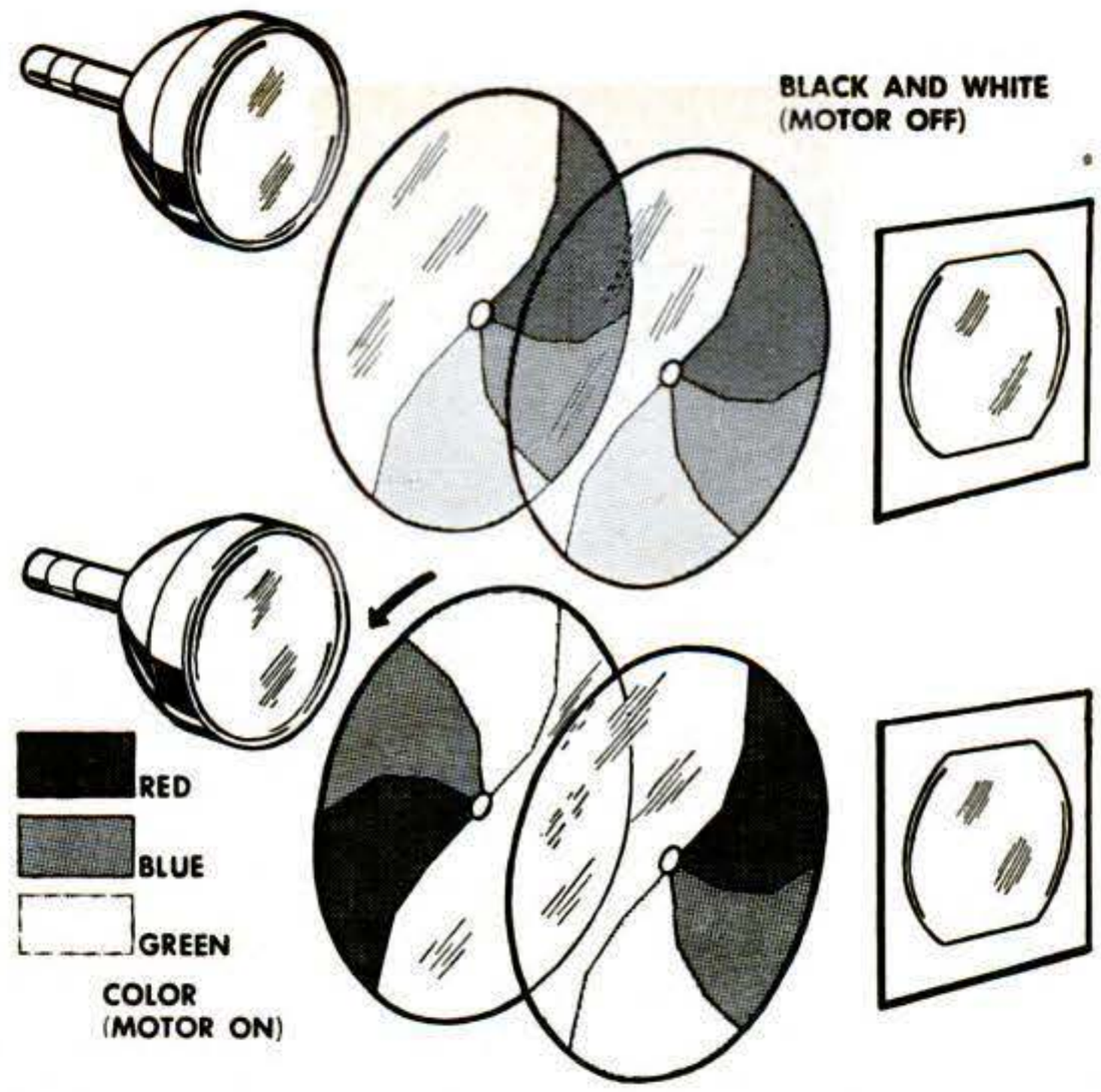
This specially designed induction motor can hold to a fairly constant speed. By itself, though, it probably wouldn't stay for long in exact step with the transmitter. To keep it locked in, the receiver uses an ingenious comparison circuit that gets its timing orders from the incoming pictures.

Wheel-speed control. A small segmented disk called an alternator is attached to the color-wheel shaft. As it turns, it cuts through the magnetic field of a tone generator. It interrupts the field at about 144 times a second.

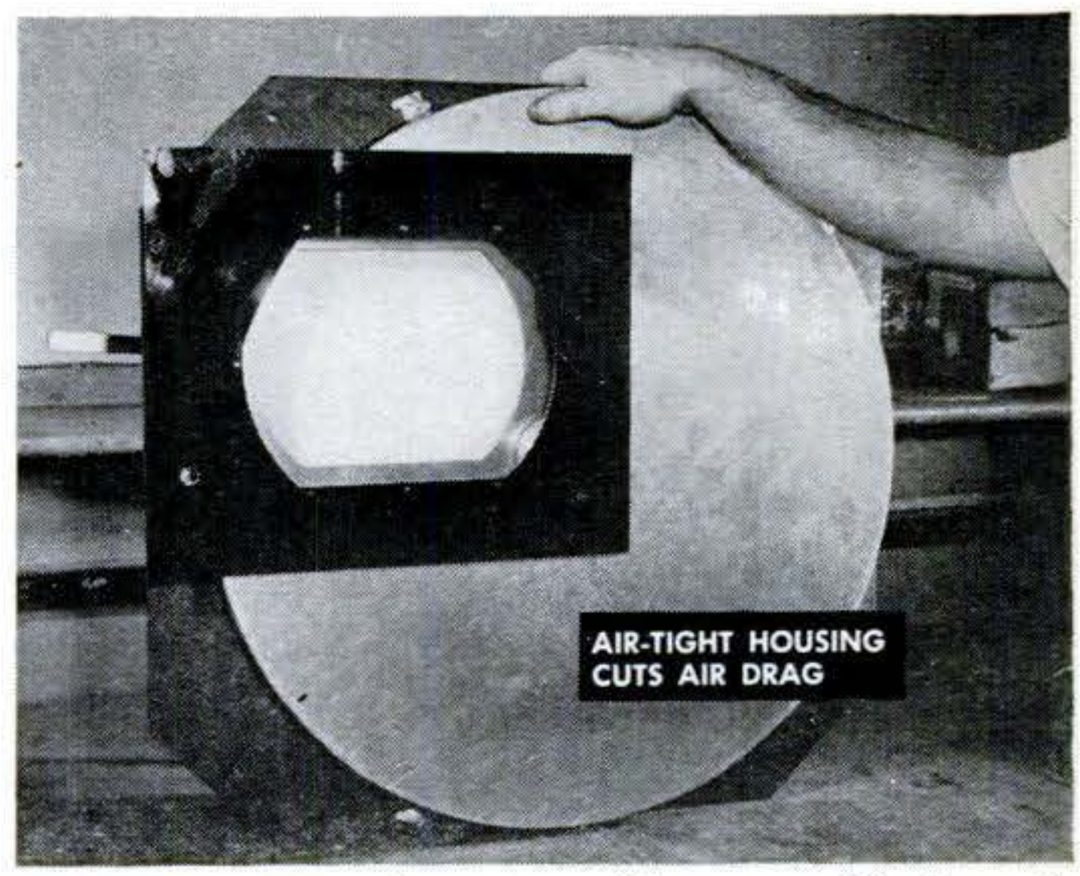
This, together with the incoming picture pulses, gives two sets of 144-cycle tones. Both are fed to a control circuit and electronically compared. So long as they are the same, nothing happens. But any difference between them results in a voltage that is fed to a special transformer called a saturable reactor. The reactor immediately responds by modifying the power that drives the motor, speeding or slowing the wheel until it keeps exact pace with the incoming picture.

Wheel-phase control. Like a rookie who marches at the same pace as his squad but out of step, the color disk in a receiver can still be wrong. It can spot the green segment in front of the picture tube when the red one should be there. When you turn the set on, the wheel may join the parade at the right speed—but out of phase.

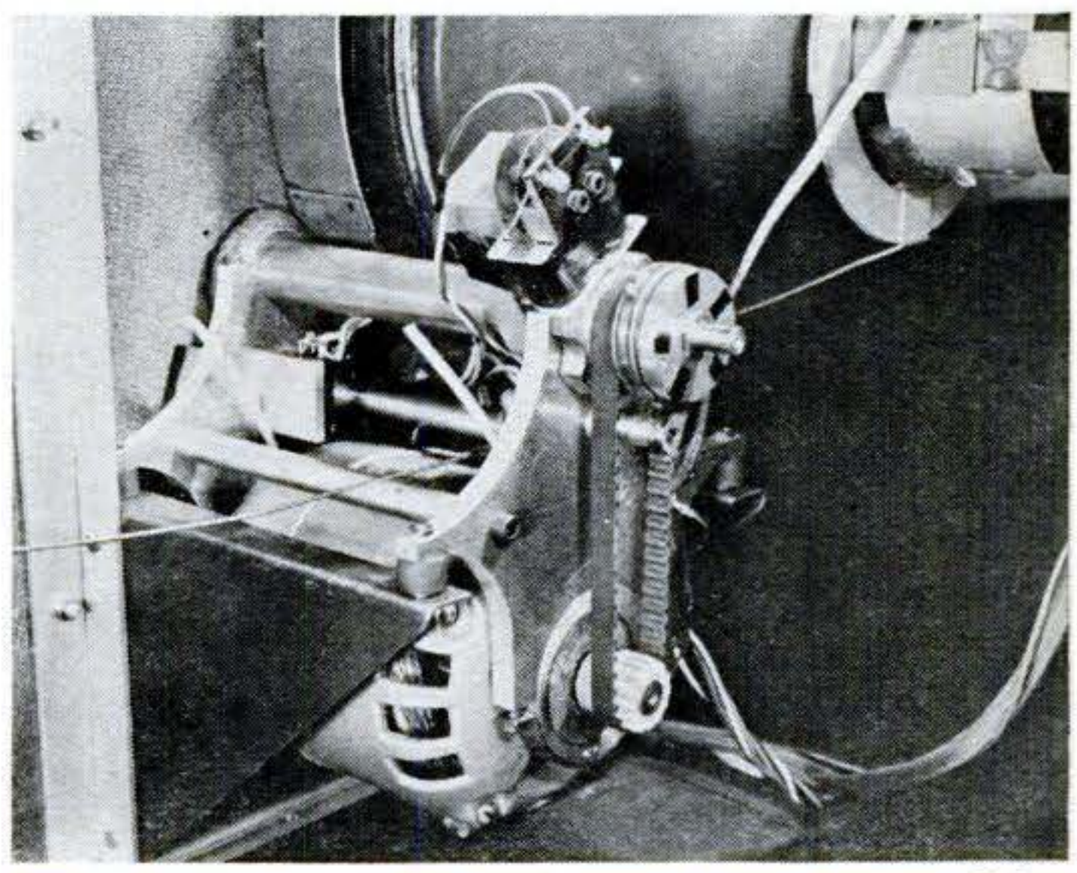
The answer to this is comparatively simple. When a green-haired singer shows up, you just touch the phasing switch on the control panel. This causes the color



Clear segments of wheels line up before panel window when motor is off (top above). When wheels spin for colorcasts, one lags half a turn behind other, giving full color wheel (bottom).



Twin wheels make it possible to see black-and-white shows without moving them aside (above). The 10-in. screen magnified to 12½-in. is as big as can be used easily with disks.



Wheel motor, its speed precisely governed by transmitter pulses, turns color-wheel shaft by a toothed belt. This gives a positive, nonslip drive, like a car's timing chain.

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drive to skip a beat, bringing the right color segment into place at the right moment. (Since there are three colors involved, the singer may look even queerer the first time you touch the switch. But just keep at it and she'll turn the right color).

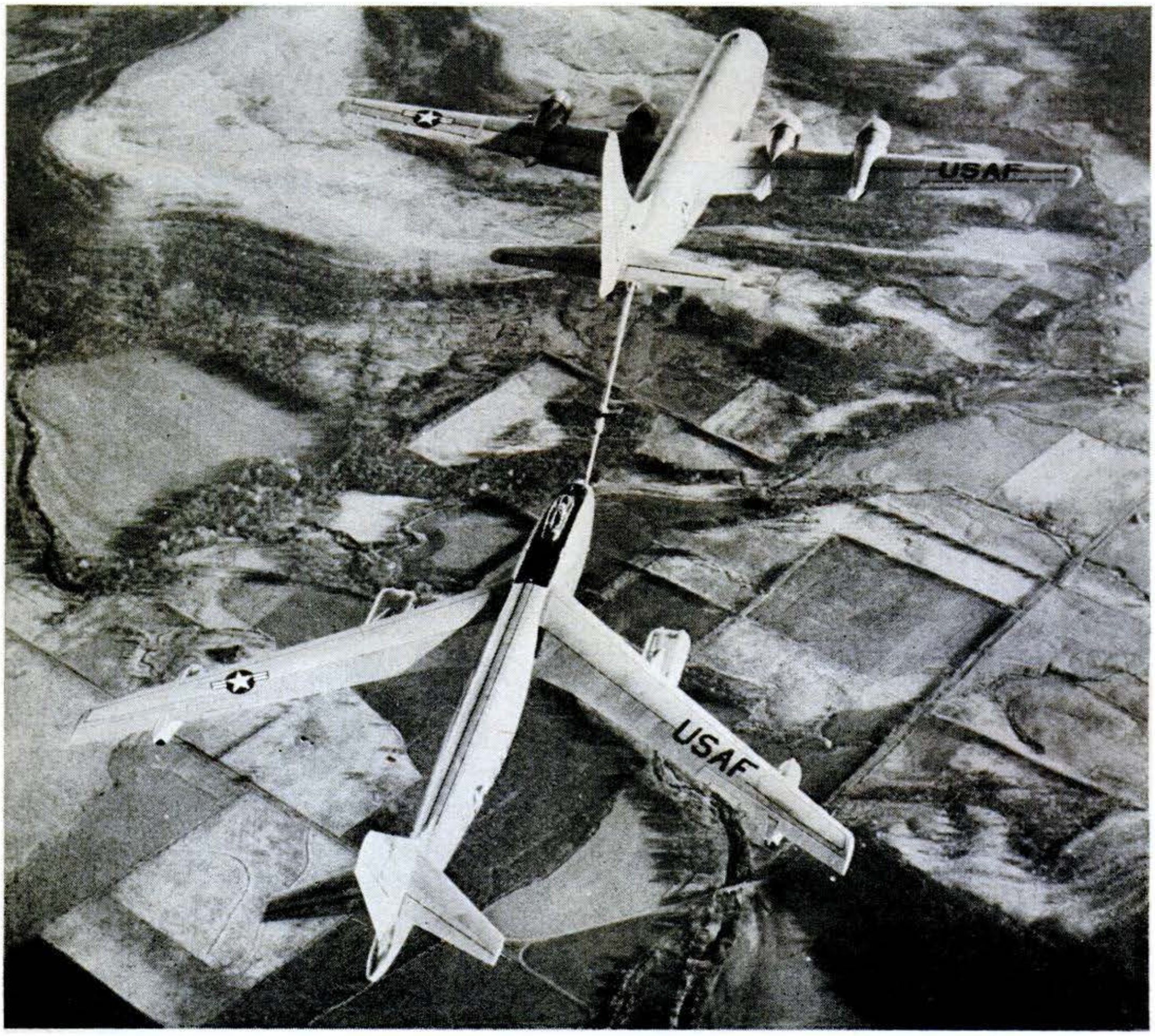
Two wheels used. Having succeeded in coloring the picture, the designers of the combination receiver were faced with a poser: what do you do with the color wheel when you want to watch a regular black-and-white program? Pivoting mounts to swing the whole rig out of the way would be bulky and cumbersome.

They licked this problem by using two wheels. Half of each one is clear plastic. The other half is divided into color segments. Each wheel turns on the same shaft, secured to it by hubs that use a clever centrifugal locking device. When the wheels spin, they are locked 180 degrees apart so the colored part of one masks the clear part of the other. In this state they amount to a single, complete color wheel. But when they stop, the centrifugal hubs and a brake bring the wheels to rest with the clear sections lined up in front of the tube face for black-and-white viewing.

This combination receiver uses a 10-inch tube, magnified by a built-in lens to 12½ inches. It'll retail for about $500, with a companion model in a plainer cabinet going for around $400.

World's Fastest Jet Bomber Drinks Fuel in Mid-Air

THE 600-m.p.h., swept-wing B-47 Stratojet Air Force bomber now can refuel its six engines in flight, as shown in the demonstration below. The boom, seen sticking out from under the tail of the Boeing double-decked KC-97A tanker plane (top) makes contact with a coupling in the bomber's nose, and fuel is pumped in at high speed.



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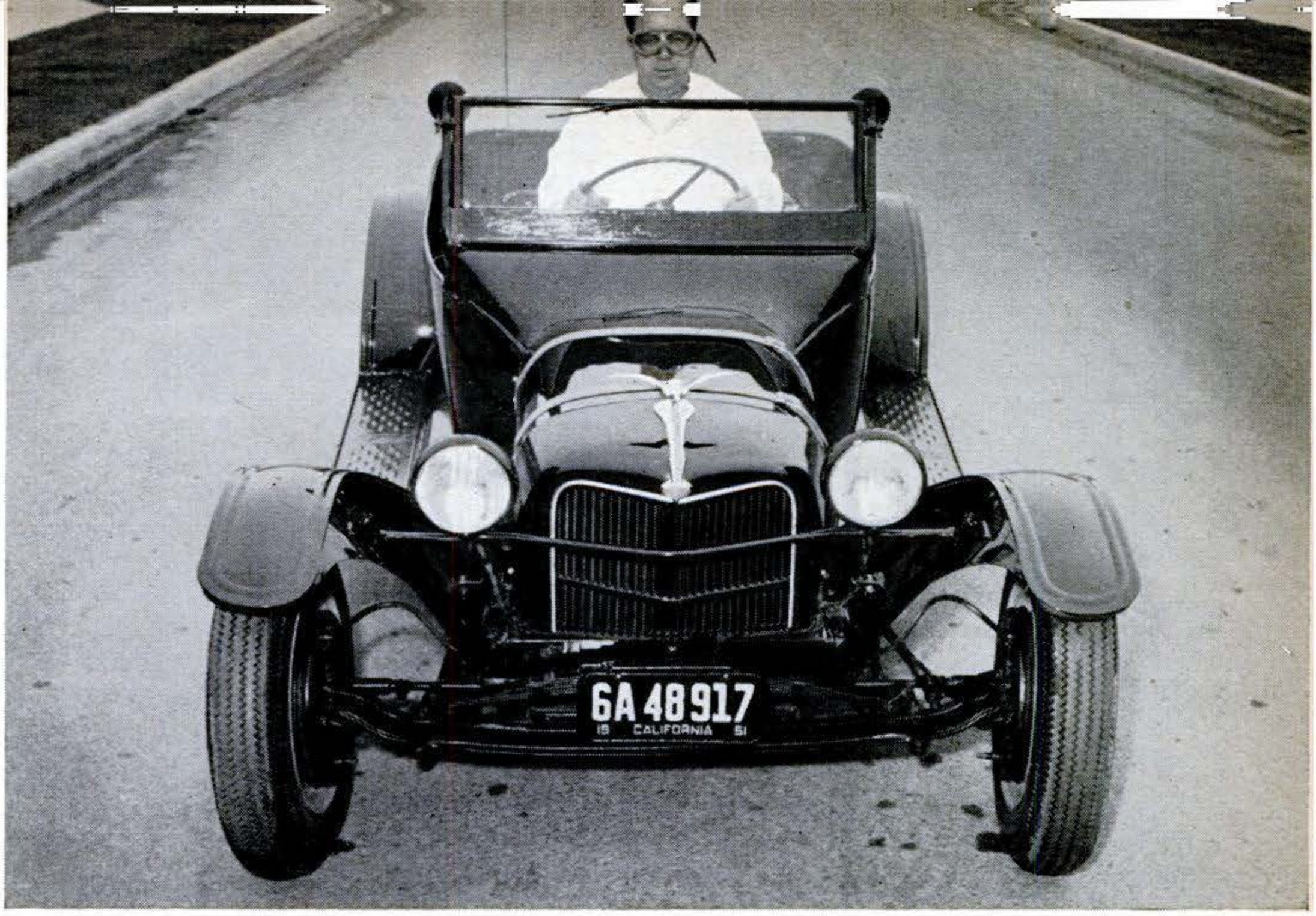
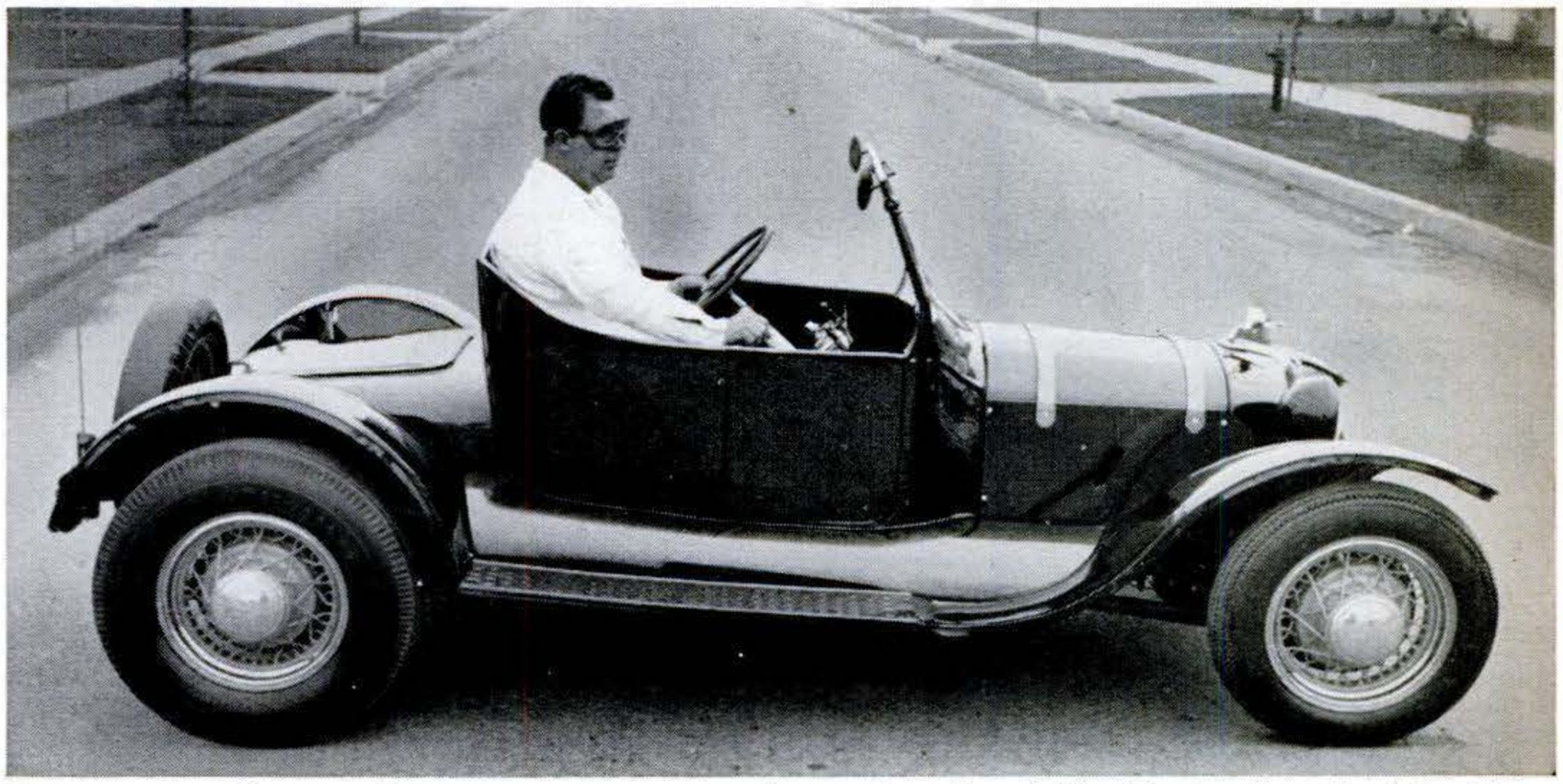


Old-Parts Jalopy Does 110 M.P.H.

HUSKY John Cunningham, California truck driver, spent $2,000 and several hundred hours building a jalopy that looks vaguely like a '32 Ford V-8 with Model T fenders. And the effort paid off. It has been clocked at 110 m.p.h.

The car has a Mercury engine. Its Model T body rides on 1930 Chevrolet frame rails. It has a Chevrolet steering gear—with the wheel set square in the center—Ford springs, '34 Ford brakes converted to hydraulics with Chevrolet wheel cylinders and rear shocks, and a Ford front axle, grille and radiator.

The car's 230-pound owner drives a 40-ton oil tanker during his working hours. END



Big rear tires for speed give car appearance of running downhill. Engine has dual ignition.

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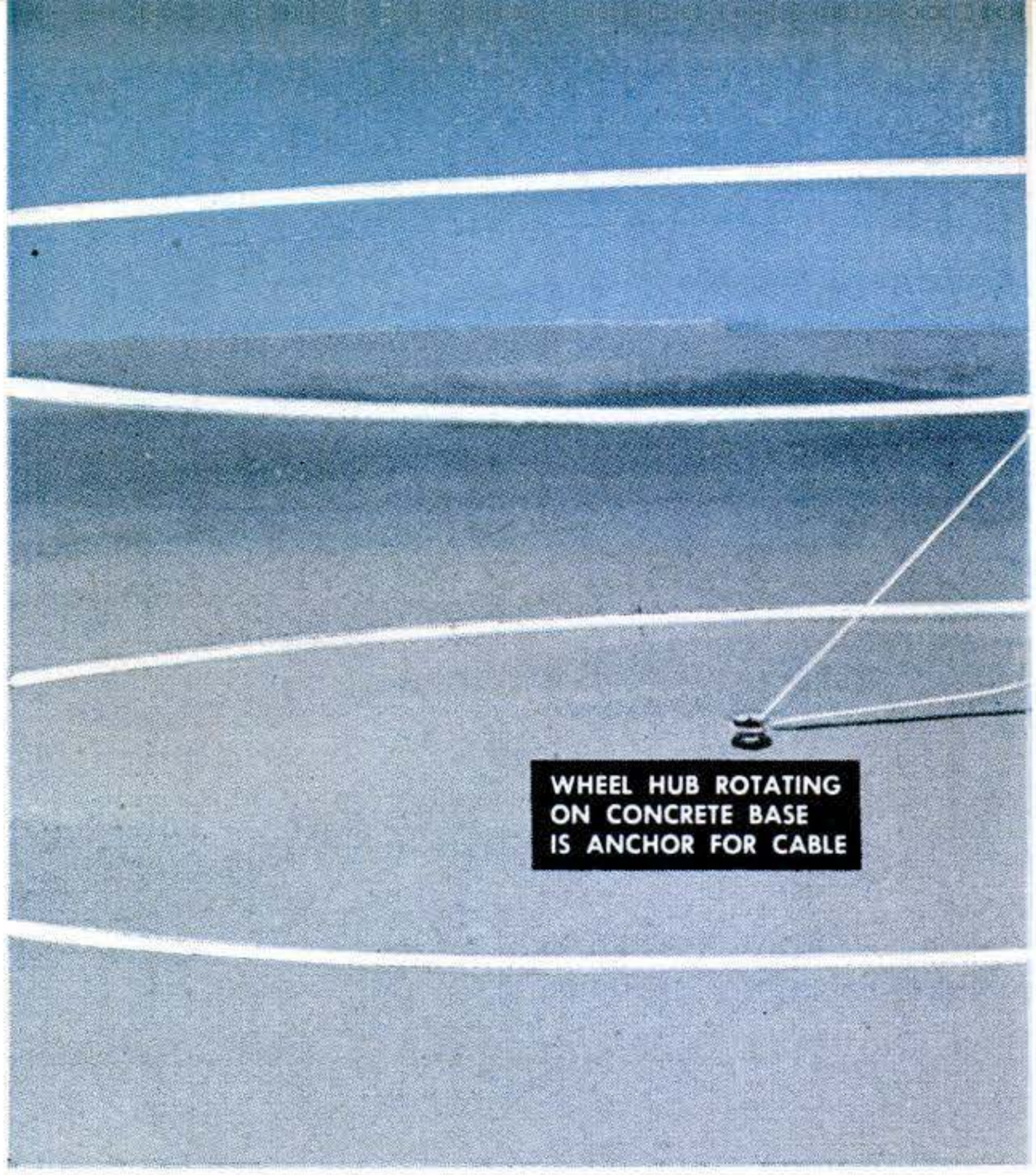
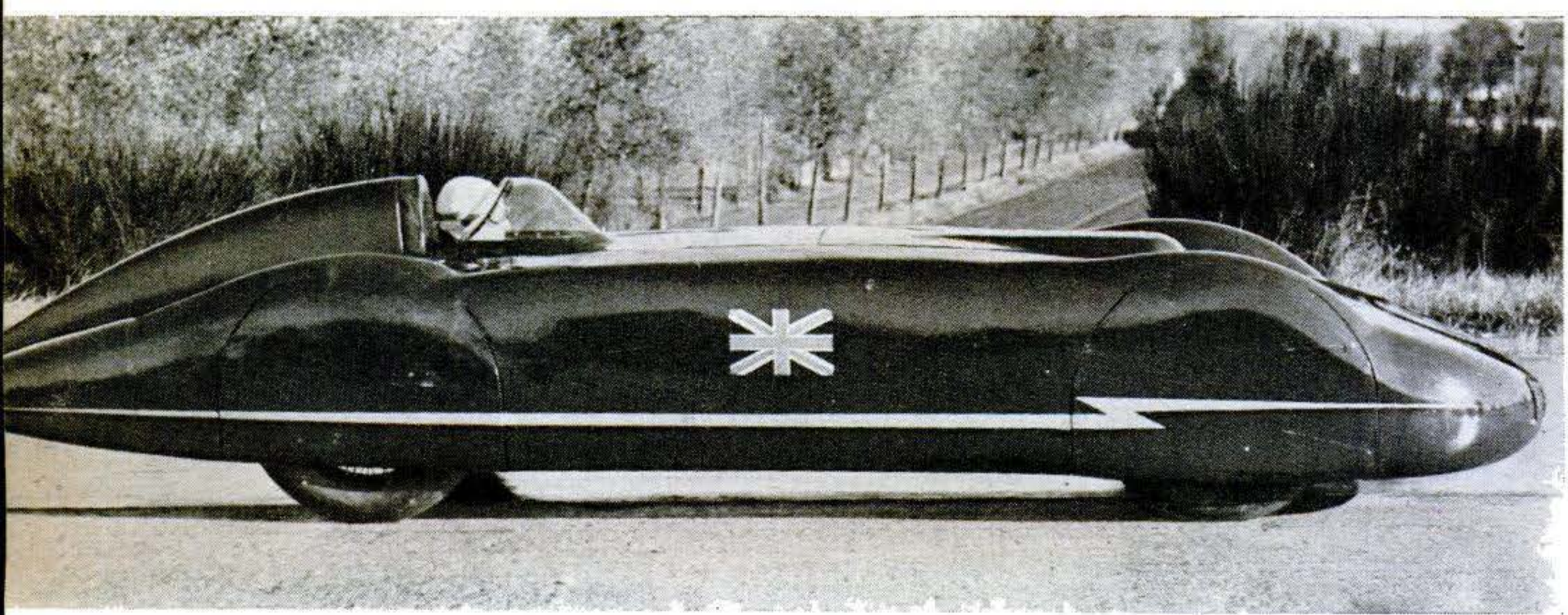
Merry-Go-Round Launches Planes

A PILOT would never "run out of runway" with this "merry-go-round" take-off device. Tethered to the ground by a cable, he would simply fly in circles until he had gained sufficient altitude, then cast off and soar away. If his engine should fail during the critical take-off period, he could circle back down and land safely on the field—instead of in a tree or on somebody's house.

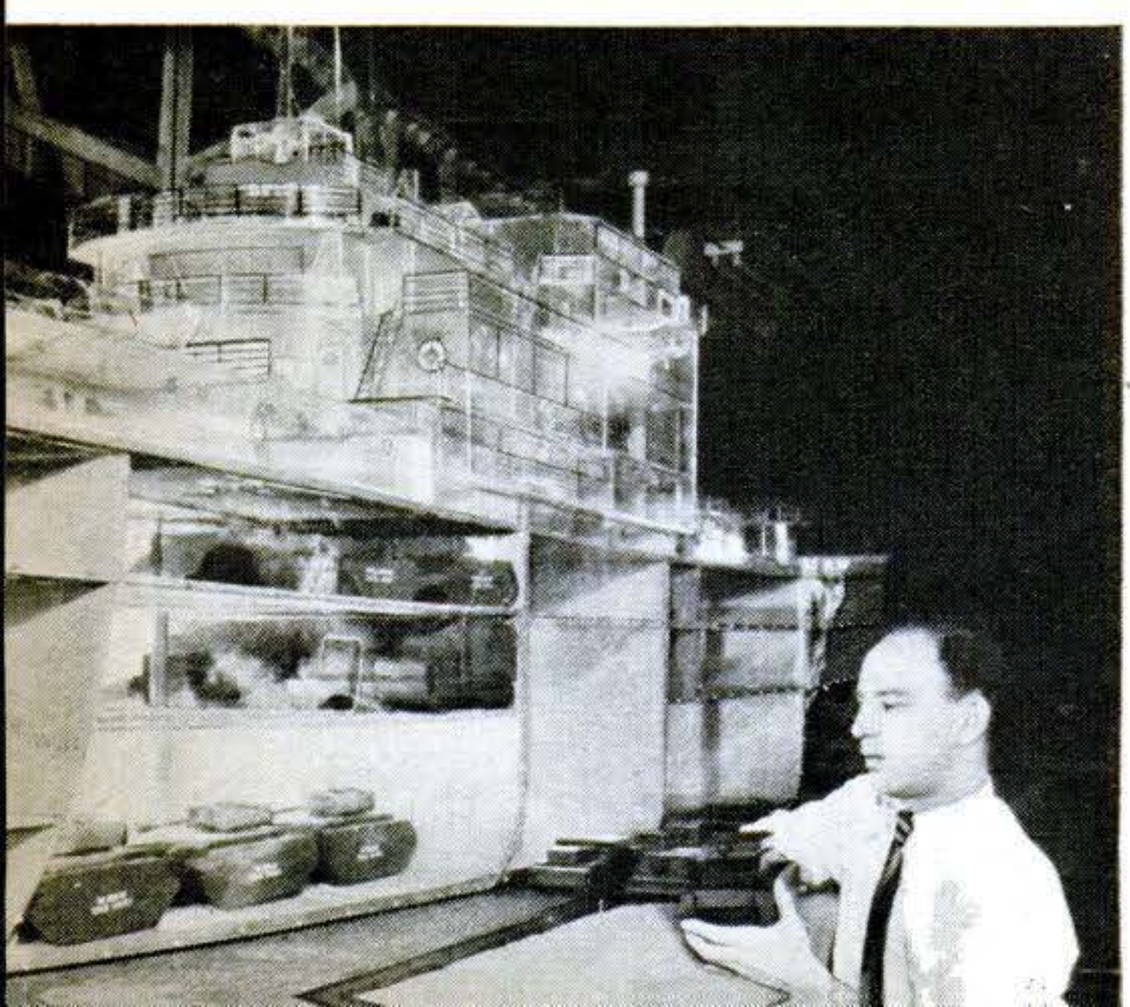
Intended to provide small fields with the equivalent of infinitely long runways, the idea dates back nearly half a century. It was first tried successfully by Jean A. Roché in an Aeronca plane at Wright Field, Ohio, in 1938. Now it has been put through tests at a Riverdale, Md., field by Sanders Aviation, Inc., using an Ercoupe. The scheme is also said to aid in test-flying new planes, keeping them within a few safe feet of the field.





Veteran Racer Is Record Challenger

THE streamlined M.G. Special above was shipped from England recently to try for new records at the Bonneville Salt Flats, in Utah, after a racing history dating back to 1938. Behind the wheel is its 60-year-old driver-owner, Lt. Col. Goldie Gardner, holder of 81 records, and the first man to exceed 200 m.p.h. in a light car. At present the car has a four-cylinder, 1,250-c.c. (76.5-cu. in.) standard production engine fitted with a supercharger.



Model Ship Teaches Loading

A 19-FOOT, transparent-plastic scale model of a cargo ship (left) helps Army officers at Fort Eustis, Va., learn how to load a vessel efficiently. Removable decks let them arrange and rearrange models of tanks, trucks, self-propelled guns, and other cargo in the holds. And when they're finished experimenting, the instructor can just look through the clear-plastic hull to see how well they've done.

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PLANE GAINS ALTITUDE WHILE CIRCLING ON CABLE AND IF ENGINE FAILS CAN LAND SAFELY

AT SUFFICIENT ALTITUDE, PILOT CASTS OFF CABLE AND PLANE IS FREE

250-FOOT CABLE

Bike Hitch Tows Child's Wagon

THE kids can make like truckers now, with aluminum attachments that tow wagons behind their bicycles or tricycles. Trike-Hitch (right) clamps to the frame of a tricycle, while Bike-Hitch (inset), which includes a red safety reflector, bolts to the rear fender and axle of a two-wheeler. The hitch lugs hold the wagon handle securely, yet allow full swivel action. The Kar-Lin Co., Minneapolis, makes them.

Machine Dispenses Folding Money

YOU'LL have to wait only half as long in line to cash a check if banks adopt a new paper-money dispensing machine. Instead of counting out bills, a cashier punches a few keys—and out comes the right amount, up to $299. A Burroughs Adding Machine Co. experimental model (left) works like a change dispenser, handling rolled bills instead of coins. An accessory desk-top machine rolls and wraps bills for its use.

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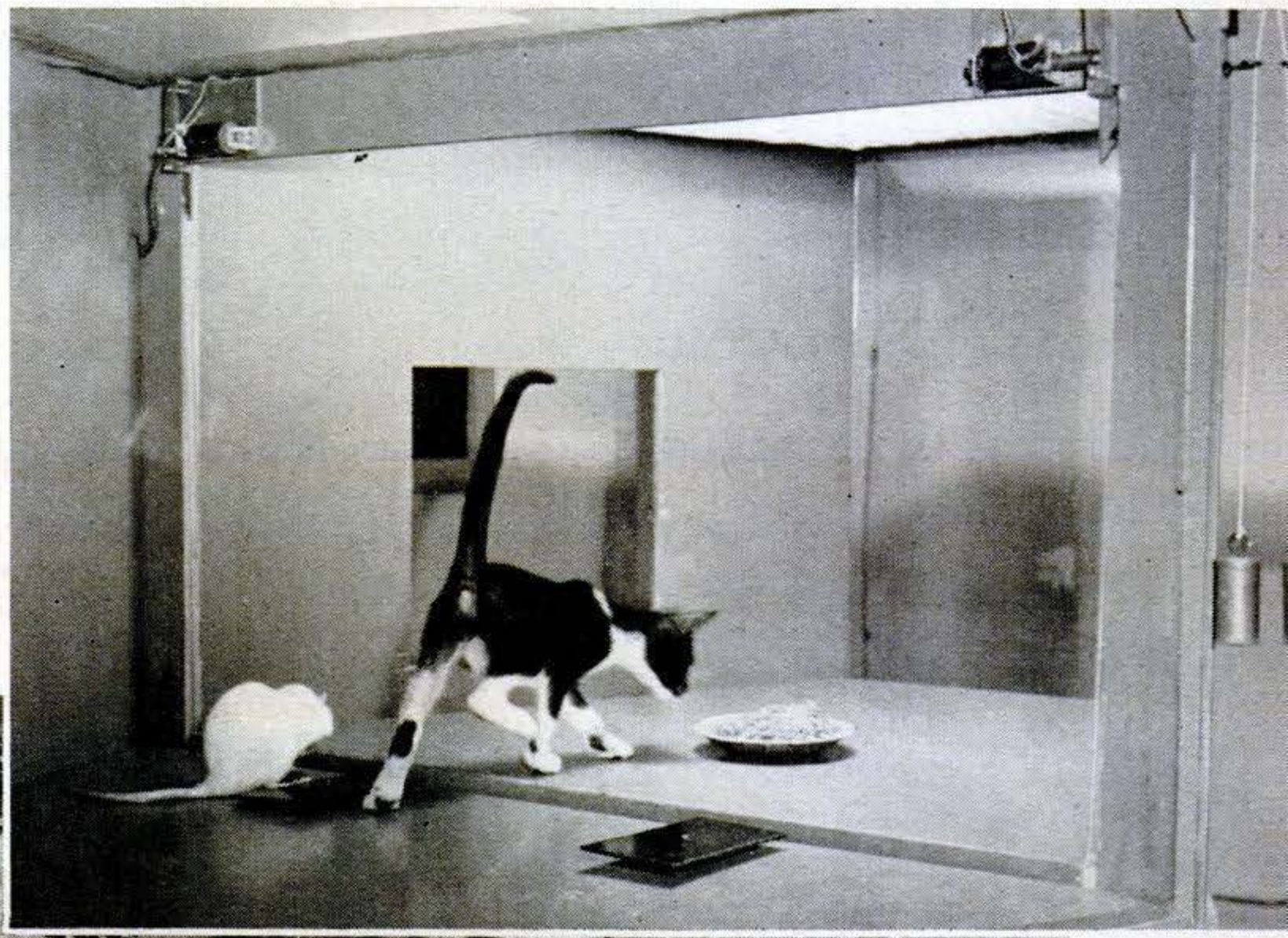
Cat and Rat Make Friends

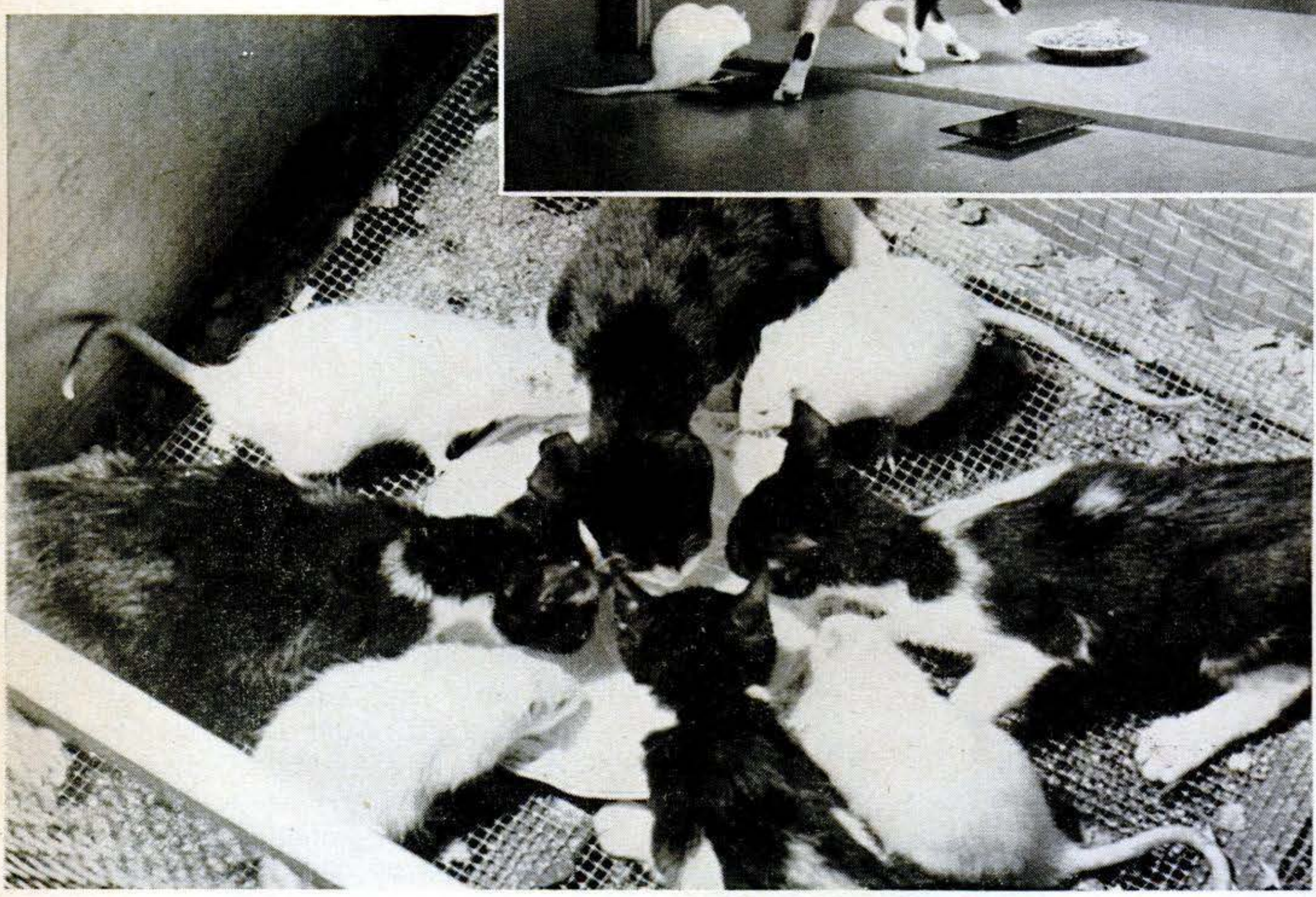
WHO says old enemies can't work out their differences and get along? The cats and rats shown on this page prove they can—especially where something as important as chow is concerned. They're subjects in experiments conducted by Dr. Loh Seng Tsai, Tulane psychology professor, to prove that these "natural enemies" can be friendly and work together.

When placed in a cage together, cats and rats quickly learned that both had to step on foot buttons at the same time to get past the glass barrier to the food. Having the animals good and hungry helped.

When do we eat? Rat and cat are ready—they see food through glass barrier, smell it over open top.



Come and get it! Cooperation pays off when buttons pressed simultaneously drop door, allowing animals to reach food.



One big happy family settles down to a tasty meal as food wins out over feud.

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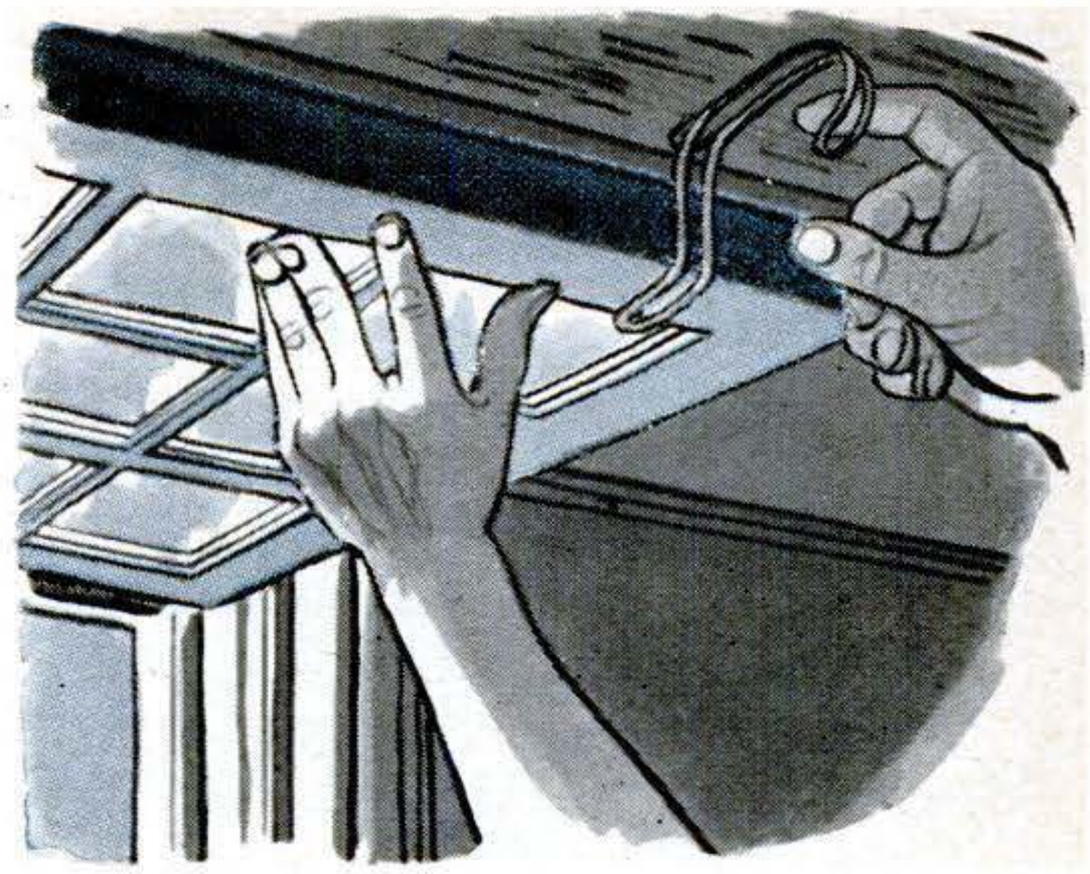
Keeping the Home Shipshape

Salt-box lids with pouring spouts can be fitted into the sealing rings of Mason jars to make handy canisters. Contents are visible and spout makes it easy to pour and measure.



A wire coat hook screwed to joist or ceiling will hold a cellar window open. Bend down the end of the hook to form a right angle. Turning it will release the window.

You won't have to be Hercules to plant a beach umbrella firmly in the sand if you cut or file a coarse screw thread on the end. It will turn into the sand easily.

Pop's shaving soap and brush will find leaks in plastic blow-up toys. Bubbles show tiny ones hard to locate any other way. Patching kits are on the market.

For a neater paint job on clapboards, do the underneath edges first. Brush several edges at a time for a few yards. Then coat the faces of the boards.

Please turn the page for five more suggestions.

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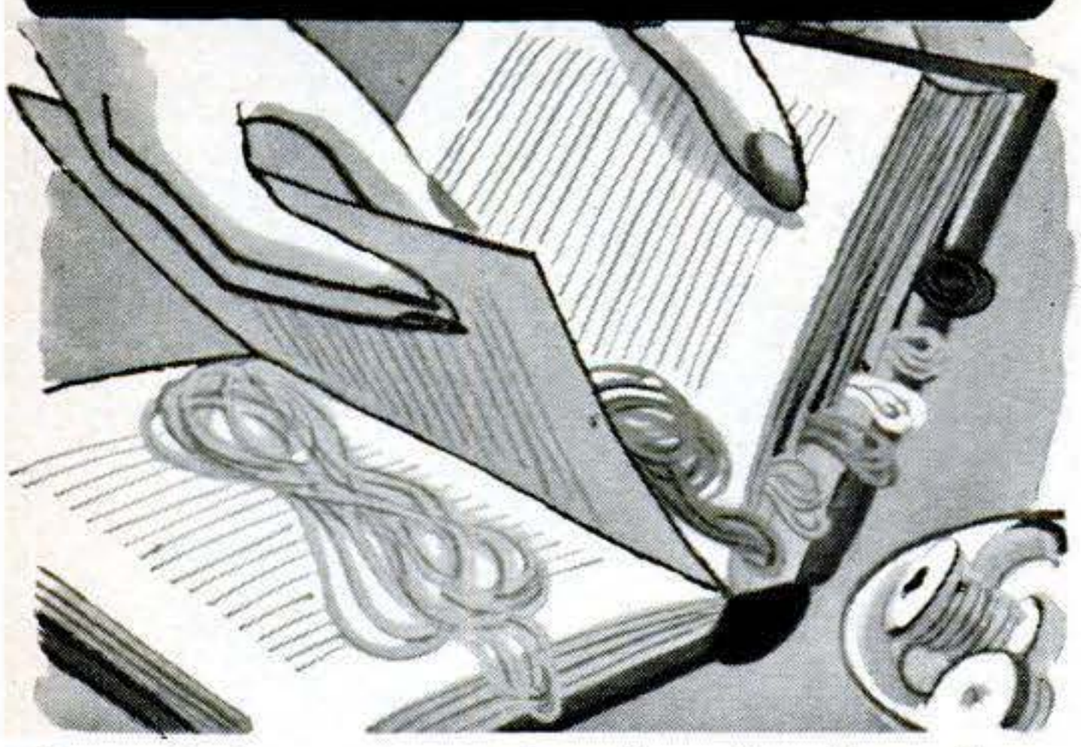
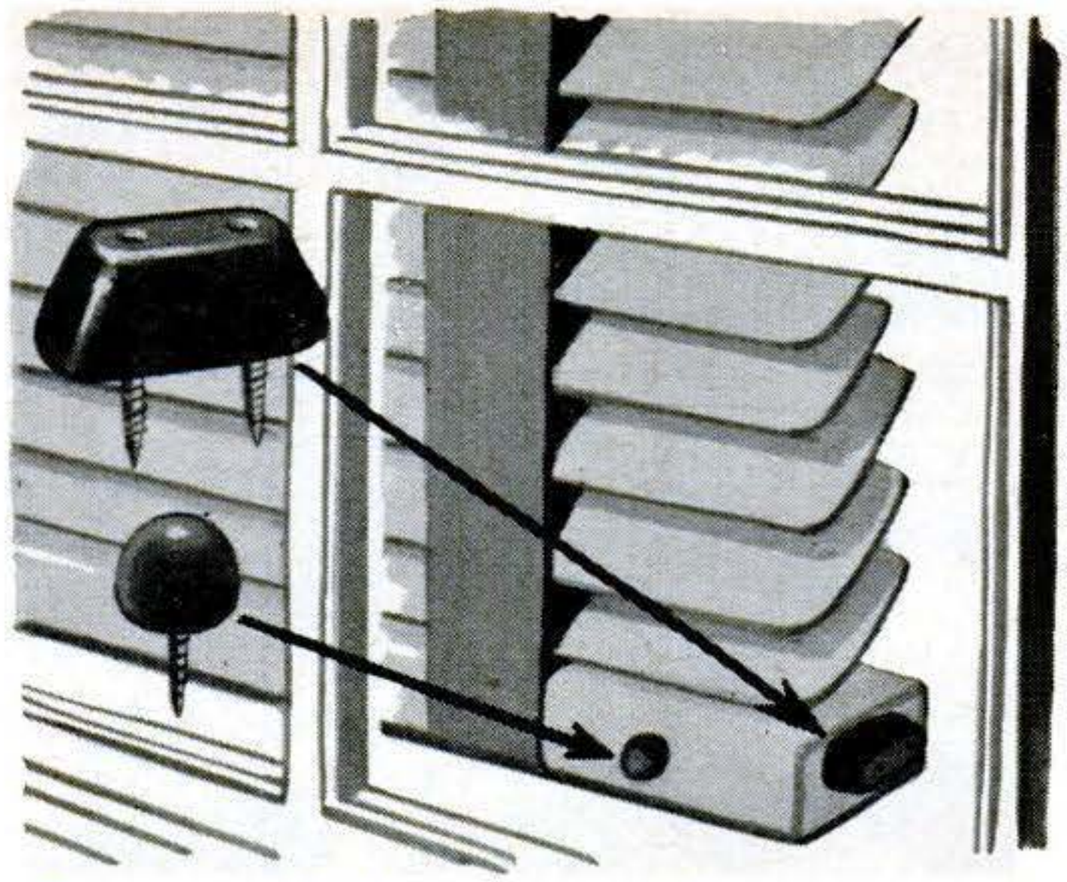
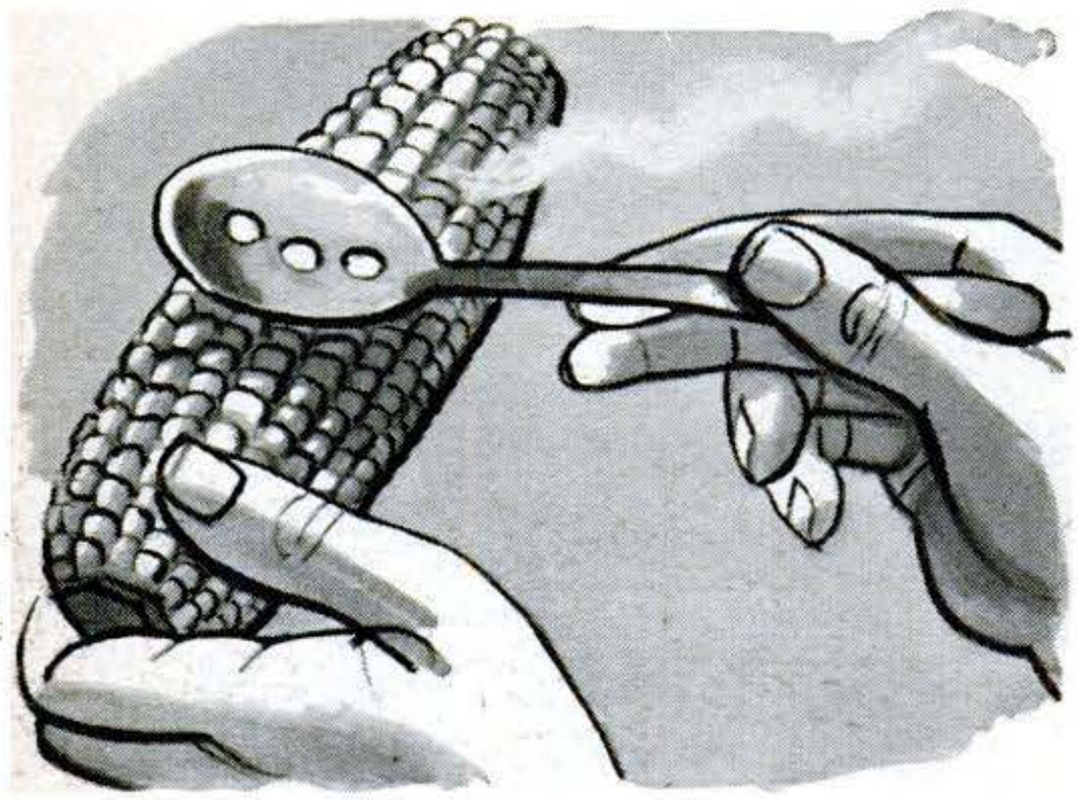
Keeping the Home Shipshape



Keep leftover strands of embroidery floss between the pages of a book. The ends of the strands peeking out at the top make it easy to pick out colors.

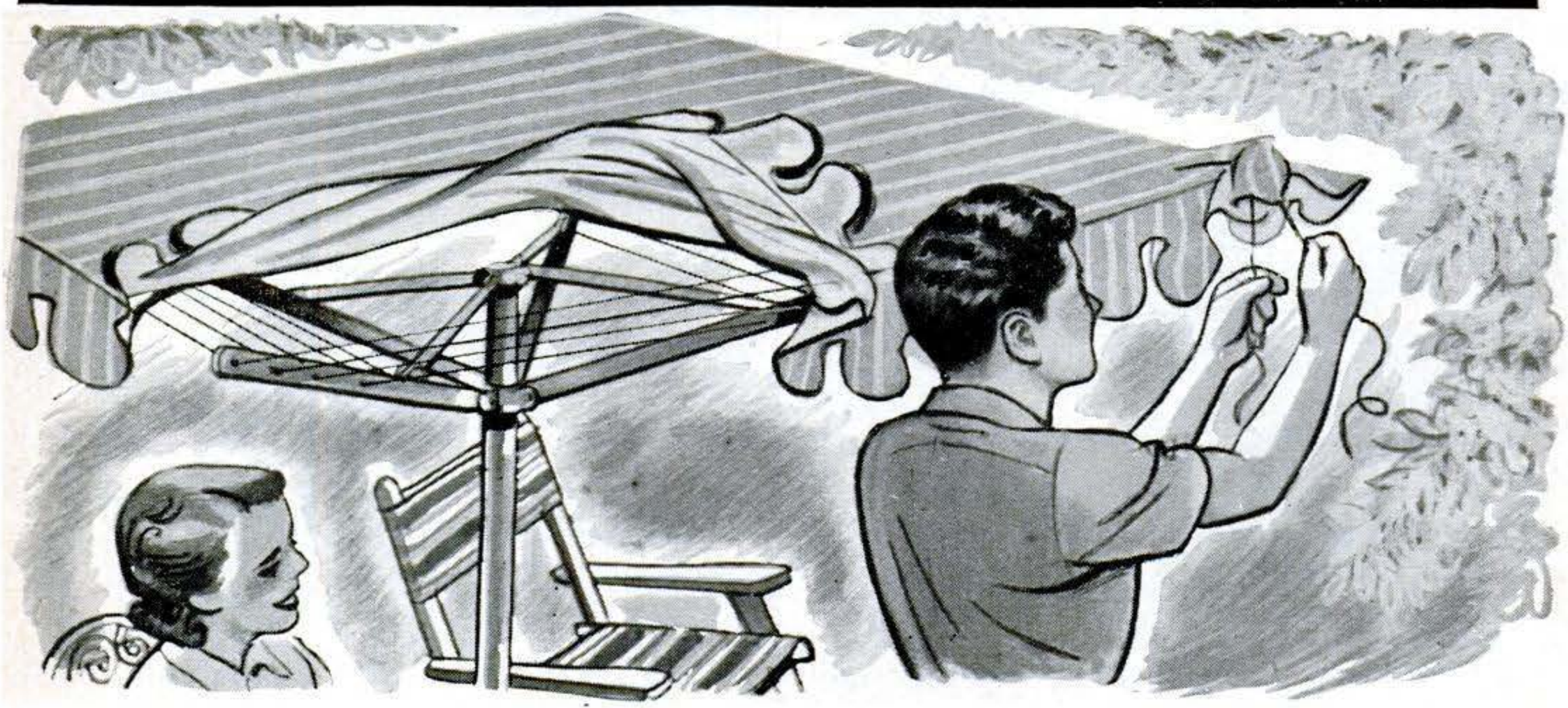


Venetian blinds sometimes bang against the woodwork when windows are open. Rubber bumpers made for toilet seats will silence them and protect woodwork. Attach as shown.



Buttering corn on the cob with a knife is a job. Try using a plastic spoon drilled with holes. Rub the butter-filled spoon over the corn and the heated butter will seep through.

A large aluminum cookie sheet will hold your toaster and several small dishes for sandwich spreads. Black plastic or chromium handles at the ends make the tray easier to carry.



An outdoor clothes dryer can be used as a handy garden umbrella if you make a simple canvas cover for it. Fasten the cover on with drawstrings or tabs and snaps.

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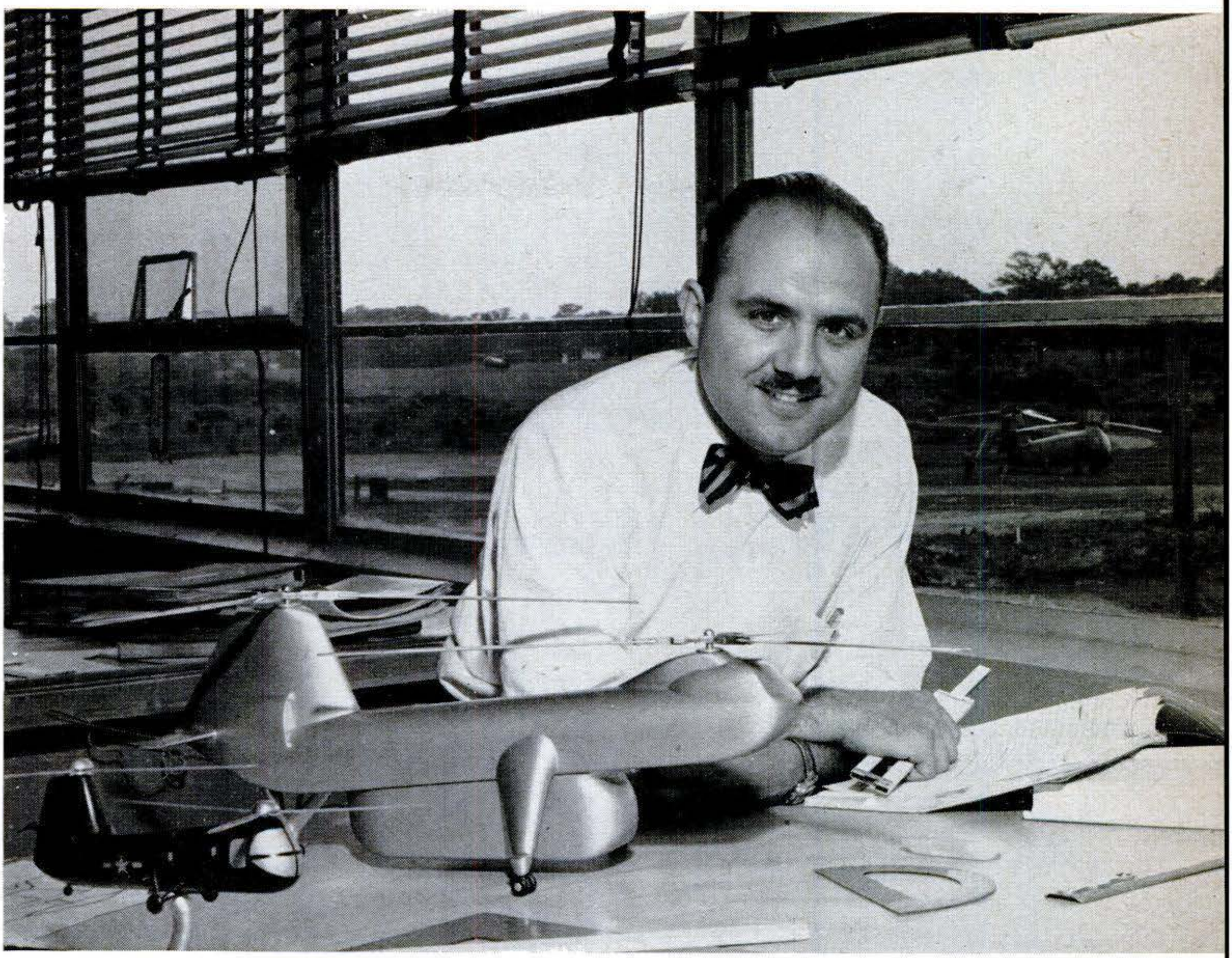

At drawing board, Piasecki dreams up new 'copters like huge XH-16 transport (large model).

The Boy Who Grew Flying Bananas

He is only 31, rich already, and still going up like his 'copters.

By L. B. White

THIRTY-ONE-YEAR-OLD Frank Piasecki (pronounced pie-uh-seck-y) is Chairman of the Board of the Piasecki Helicopter Corporation, but don't let that fool you: his chief business is making liars out of defeatists.

Take the skeptics who assured him, when he was 15, that his dream dragonfly had no future: eight years later, with only 14 hours in a Piper Cub behind him, Frank took his junk-yard-assembled PV-2 up for a trial spin—and went on to develop the two-rotor tandem principle of rotary flight. He is now the builder of the world's fastest "egg beater"—and also its largest.

Or take the military, which a decade ago had never used a rotary-wing craft, and a year ago had never employed one in combat: now the Navy, Army, and Air Force can't get 'em off the hand-assembly lines fast enough—and enthusiasts are babbling about "helitactics" that may completely alter the logistics of warfare (PS, July '51, p. 89).

At 20, sun-bronzed, dark-eyed "Pi" (as he is known to most of PHC's 2,000 employees) had successfully disproved the theory that

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FROM THIS . . .

When Piasecki took his first "junk-yard" helicopter up in 1943, his plant was an old garage.

young men cannot get their dreams off the ground in a ceiling zero of hard times, tight credit, and widespread unemployment such as the mid-1930s offered. At 23, both he and his dream were airborne.

At 31, he has thrust his familiar black Homburg, jaunty mustache, and bow tie into an income bracket pierced by only a fraction of one percent of the human race. Given his known rate of forward speed, it seems probable that, before he is 40, this gee-whiz kid of big-time aviation will have zipped past the last of the artificially contracted horizons of the Jeremiahs who argue that the age of opportunity has vanished.

It's a Young Man's Game

Come to think of it, the Jeremiahs never have squelched the boy geniuses of the helicopter business. Sikorsky, granddaddy of the egg beaters, now 62, built his first helicopter (it didn't fly) in his father's back yard in Russia when he was 20. Stanley Hiller, Jr., boy-wonder of the windmills, had a $100,000 business at 14.

Frank Piasecki's parents were Poles who fled Russian rule during World War I and settled in Philadelphia. There Piasecki's dad set up a tailor shop that brought him neither poverty nor riches. When Frank was five, his father gave him a violin, hoping to make him a concert artist. After eight years' diligent practice, the young high-school junior was rewarded with a model plane. It flew—and that took the pressure off Kreisler and Heifetz.

Bike Shop Made 'Giros—and Exercycles

He dreamed, as Leonardo da Vinci had four centuries before, of a machine that would rise vertically, move in any direction, and hover like the dragonflies that criss-crossed the sluggish Schuylkill on a hot summer day. At that time, the first successful helicopter flight in this country, by Sikorsky, was four years away. But over in Camden, N. J., Wallace Kellett was fooling around with Autogiros in his bicycle shop. The day he got his high-school diploma, Frank signed on with Kellett.

Foreman Bill Swann put the fledgling aerodynamicist to work, not on the whirligigs, but on Exercycles for plump matrons. First day, he turned out more than his

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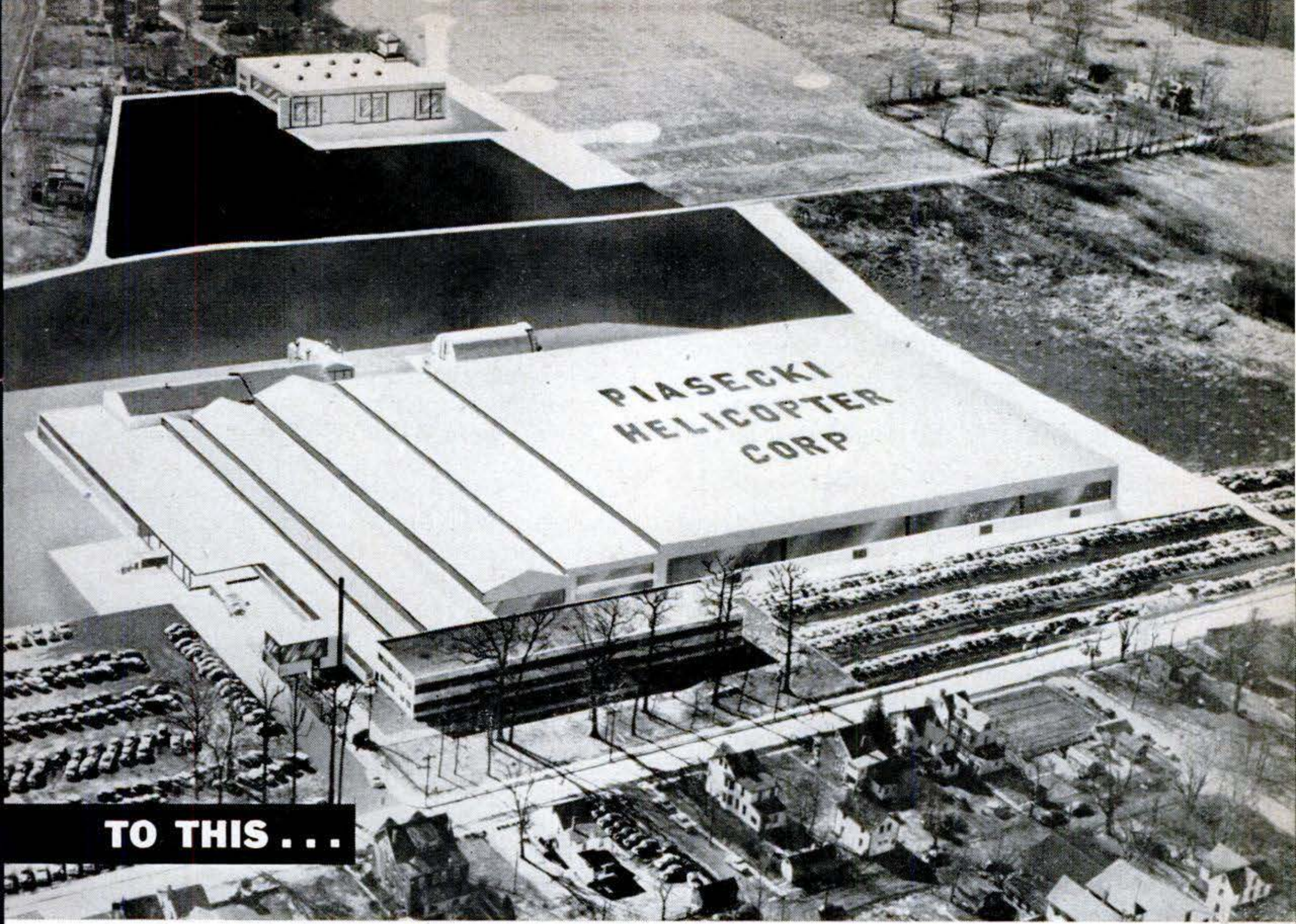

By the end of this year, Piasecki's main plant, located at Morton, Pa., will look like this.

quota; Swann raised it. Second day, same thing. Also third and fourth days. Frank kept thinking that if he made enough Exercycles, they might set him on 'giros.

"Son," said Swann, as the fifth day dawned, "you aimin' to get rich?"

The young eager beaver, who stood to earn pretty close to $15 for the week's superhuman effort, grinned hopefully.

"Well," said Swann, "fact is, you've worked yourself out of a job altogether."

Positions Reversed Now

Piasecki likes to twit Bill Swann about that every time he bumps into him at the Piasecki plant in Morton, Pa. (Oh, yes: Bill's a foreman at PHC now. "I made up my mind," his present boss says, "that any man who could fire people so painlessly belonged on my team.")

Other jobs followed that summer of 1935. Frank began working his way through a three-year course at the University of Pennsylvania. Then he switched to New York University, to study rotary-wing design.

The young zealot was earning while he learned. But working for others wasn't quite good enough. In 1940 Frank and five working pals who also wanted to make aviation-engineering history met in a coal-stove-heated empty store and organized the P-V Engineering Forum. The "V" stands for one of the partners, Harold Venzie. Of the others, F. J. Kosloski, Donald N. Meyers, Elliott Daland, and Walter Swartz, the latter three are with Piasecki today.

Some business came, but nobody asked them to make a helicopter. Then Pearl Harbor put the U. S. Armed Services in a mood to underwrite development in all directions. Piasecki realized that, to get a hearing, he would have to get a ship up. He bullied his partners into pooling their small salary margins and badgering their relatives for loans. The Forum moved to a garage.

With bits and pieces from a near-by Pennsylvania Railroad junk yard, buying nothing but their engine, the six men labored before and after regular work to put together the PV-2.

Meanwhile the Navy was looking for a rescue craft that could pull ditched fliers from sea to deck in the roughest weather. For helicopters to do that job demanded

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greater stability with a greater pay load.

Helicopters flying then gained "stability" by a side-spinning rotor at the tail that counteracted torque—but did nothing else. Piasecki long had reasoned that two coequal rotors in tandem would not only overcome torque, but would give an egg beater added lift and thrust. This stability solution, he reasoned further, also would give the 'copter added carrying capacity—making the will-o'-the-wisp windmill a helicopter hauler.

So It Won't Work, Eh?

A distinguished fellow-aerodynamicist gloomily predicted that the downwash of the front rotor would so upset the rear rotor that the machine would suffer terrific vibration and loss of efficiency. ("Experts," Charles F. Kettering once remarked, "are the fellows who can find why an idea won't work.") Frank ran a wind-tunnel Schlieren test that proved these fears were groundless. And on Feb. 1, 1944, the Navy told the boys to go ahead and see what they could do with the PV-3 (XHRP-1).

The six partners worked 14 to 16 hours a day. Thirteen months after getting the green light, Frank Piasecki took up the world's first transport helicopter, the first tandem model to fly successfully.

Thus was born the famous Flying Banana. The admirals quickly ordered 10 more, then another 10. Today these are mostly being used to train Marines.

From March 1945 on, Frank Piasecki was in the helicopter business. But he still needed capital. Laurance S. Rockefeller solved that problem. With a few other financiers, he took over a controlling interest in what became, in 1946, the Piasecki Helicopter Corporation.

The corporation has shown a profit every year. Frank's stock in it now is said to be worth over a million. Already on two full shifts, PHC expects to have a $10,000,000 pay roll this year. What is more significant, it has a hog's third of $300,000,000 in helicopter orders from the armed forces. And the reason is not hard to find: PHC's brisk young chairman has got some neat jobs coming off the line.

One of these is the H-21, an improved version of the Flying Banana. The Air Force has settled on this as its all-purpose rescue craft and the Army and Marines will use it for transport. Carrying a crew of two and ranging up to 300 miles, it was originally designed to pick up 7 to 10 men from the sea; now it is to be used over ice ledge, rice paddy, and jungle.

The second Piasecki model in production is the HUP, which the Navy regards as its all-purpose work horse for shipboard service. Tandem rotor clearance is achieved by mounting the rear rotor on a pylon, instead of by the sway-back Banana configuration. With blades folded, it will descend in the smallest carrier elevator.

Next the Trailer-Truck 'Copter

But by far the biggest (and hottest) news from PHC is the recent go-ahead on the XH-16.

The XH-16 is still an experimental project. It has been called "the trailer-truck of the future." It will carry at least 40 men and/or an attachable-detachable prepacked pod the size of a Greyhound bus. The fuselage has the general shape and dimensions of the Convair Liner. Equipped with twin engines (with all sorts of primary and

[Continued on page 222]

Sign of the times. Motorists using the road below are warned to watch out for low-flying helicopters, like this Flying Banana coming in to settle down at the Piasecki heliport.

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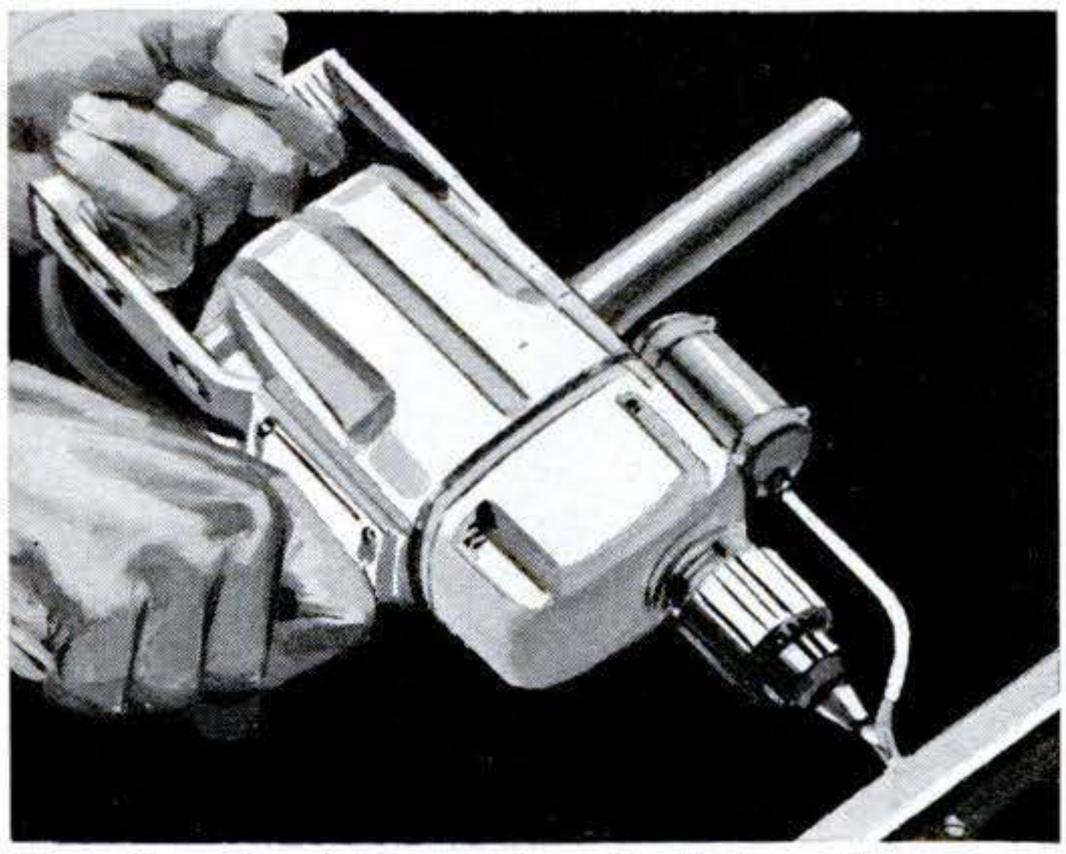
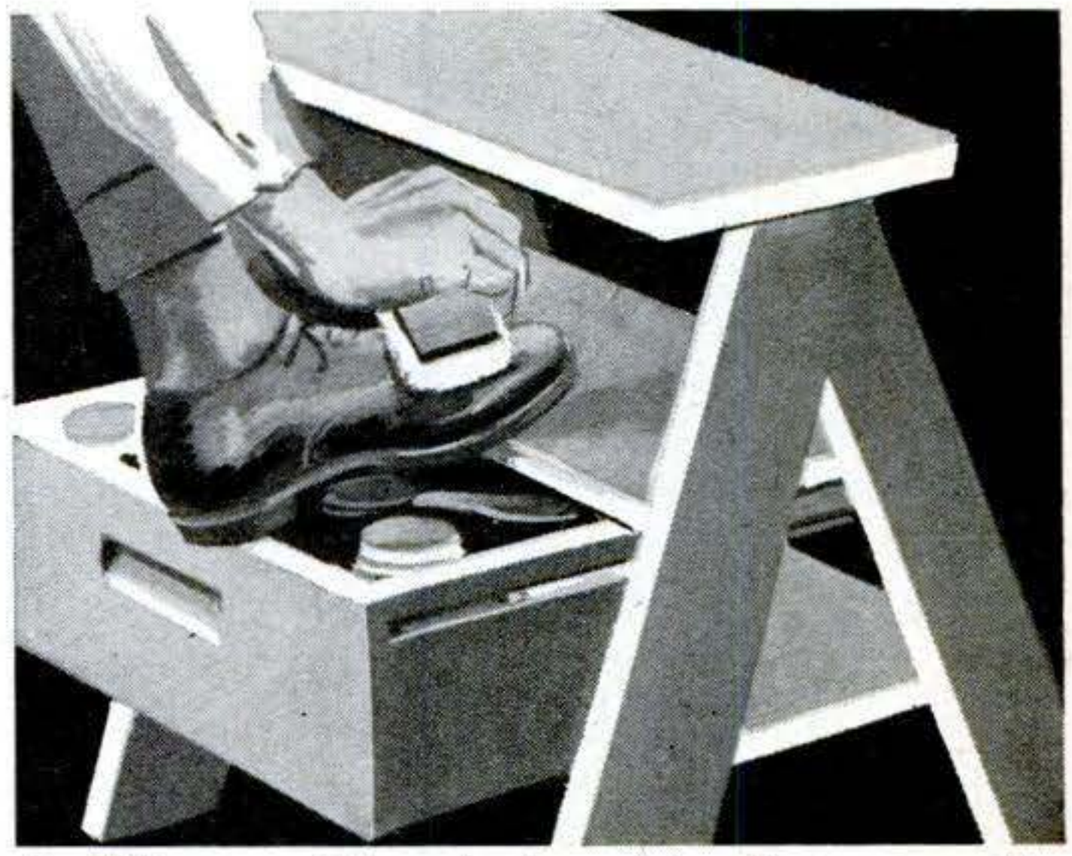
I'd like to see them make...

Everyone has his own pet idea of some gadget he would like to see in general use. What is YOURS? *Popular Science* will pay $5.00 for each one published. Use government postcards only. Contributions cannot be acknowledged or returned.

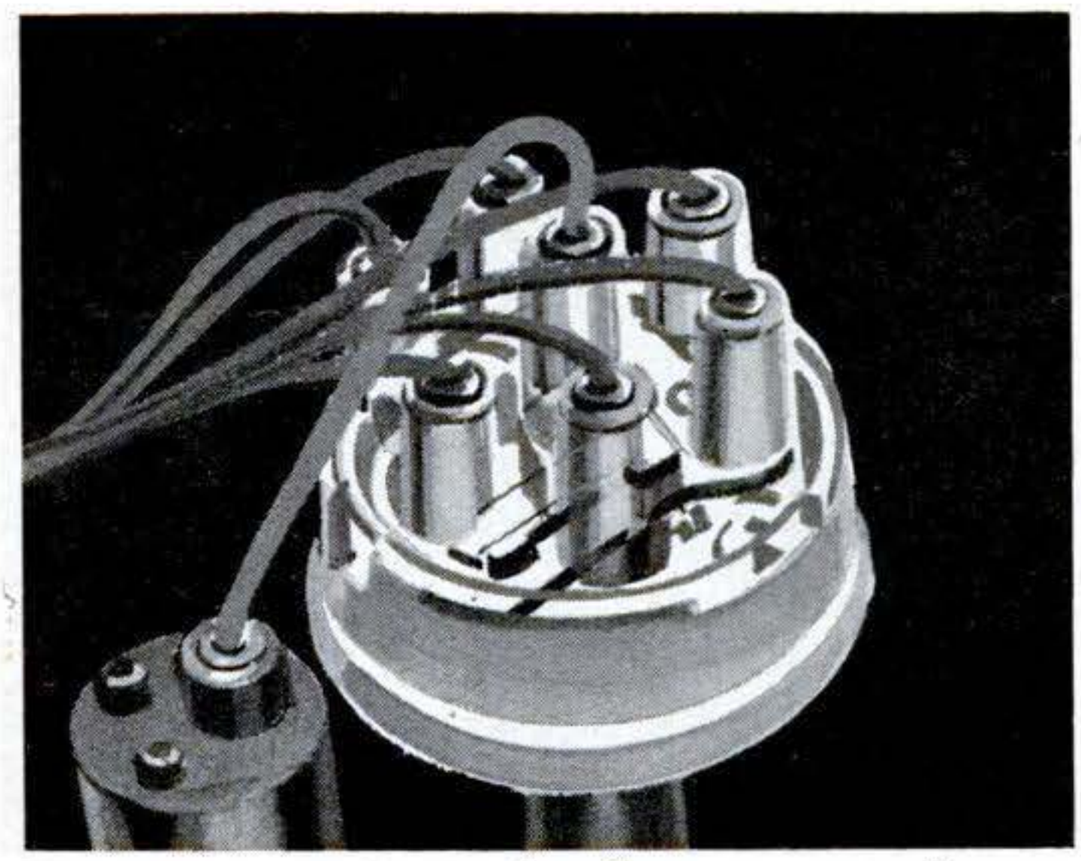
A clip-on generator for use on outboard motors. It could be a low-voltage, permanent-magnet type, delivering enough juice for running lights or for a spotlight to help you pick up a dock.—*J. Z. Reeves, Vanderbilt, Tex.*



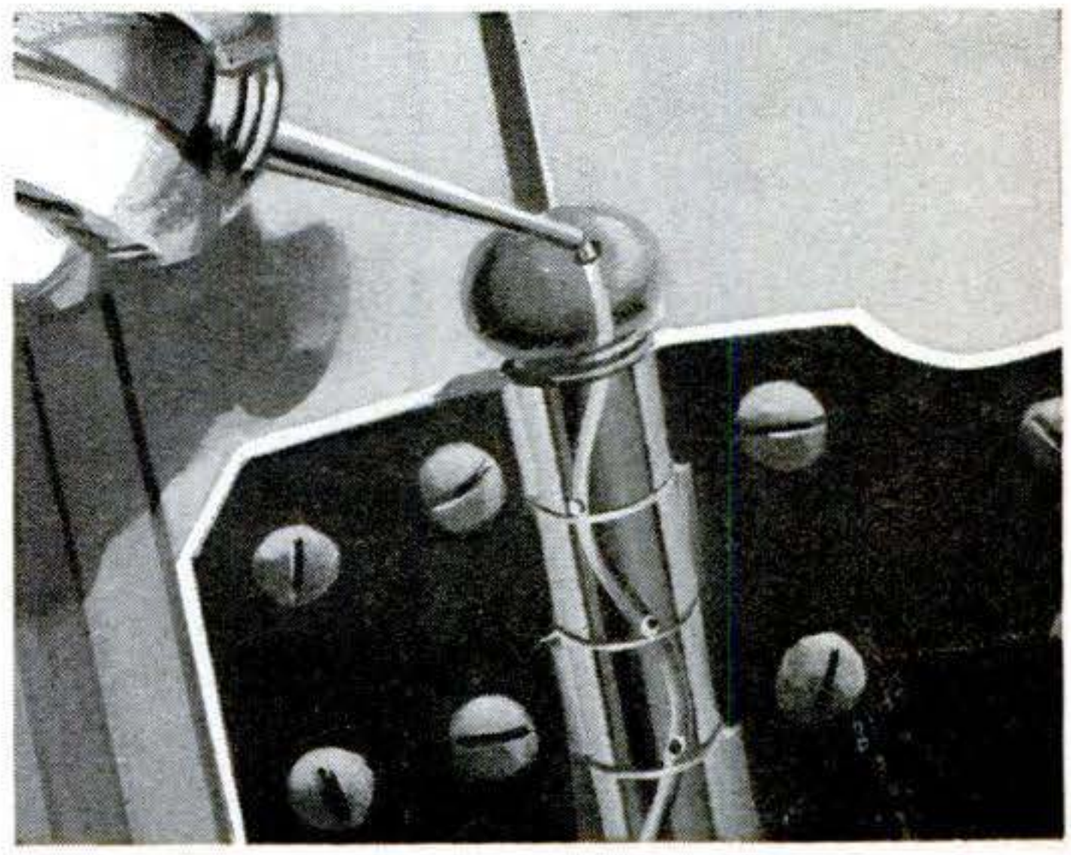
An electric drill with a built-in oil squirter similar to the water feed on dentists' drills. Then you wouldn't have to stop to add cutting oil when drilling metal.—*Ralph Jacobsen, Staten Island, N. Y.*



A sliding, or hinged, shoe-shine footrest on the middle step of kitchen stepstools, with a drawer to hold shoe-shining equipment inserted under a step or under the top of the stool.—*Dean Riggins, Huntington Park, Calif.*



Transparent plastic distributor caps and rotor arms for cars. They'd make it easy for mechanics to locate, under running conditions, such distributor troubles as high-voltage leaks and shorts.—*J. N. Ellis, St. John, N. B.*



Hinges with an oil hole near the top of the hinge pin, leading to a spiral groove down the length of the pin. Then squeaking doors could be quieted without removing the pin.—*Edward Wujcik, Detroit.*

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Blower Adds Zip to the Family Car

A supercharger will give you plenty of horses under the hood—and keep you on your toes learning to handle them.

By Hartley E. Howe

"I STEPPED on the gas, lightly I thought, to pull around a car, and before I knew it I was going so fast I was past my street and a block beyond it."

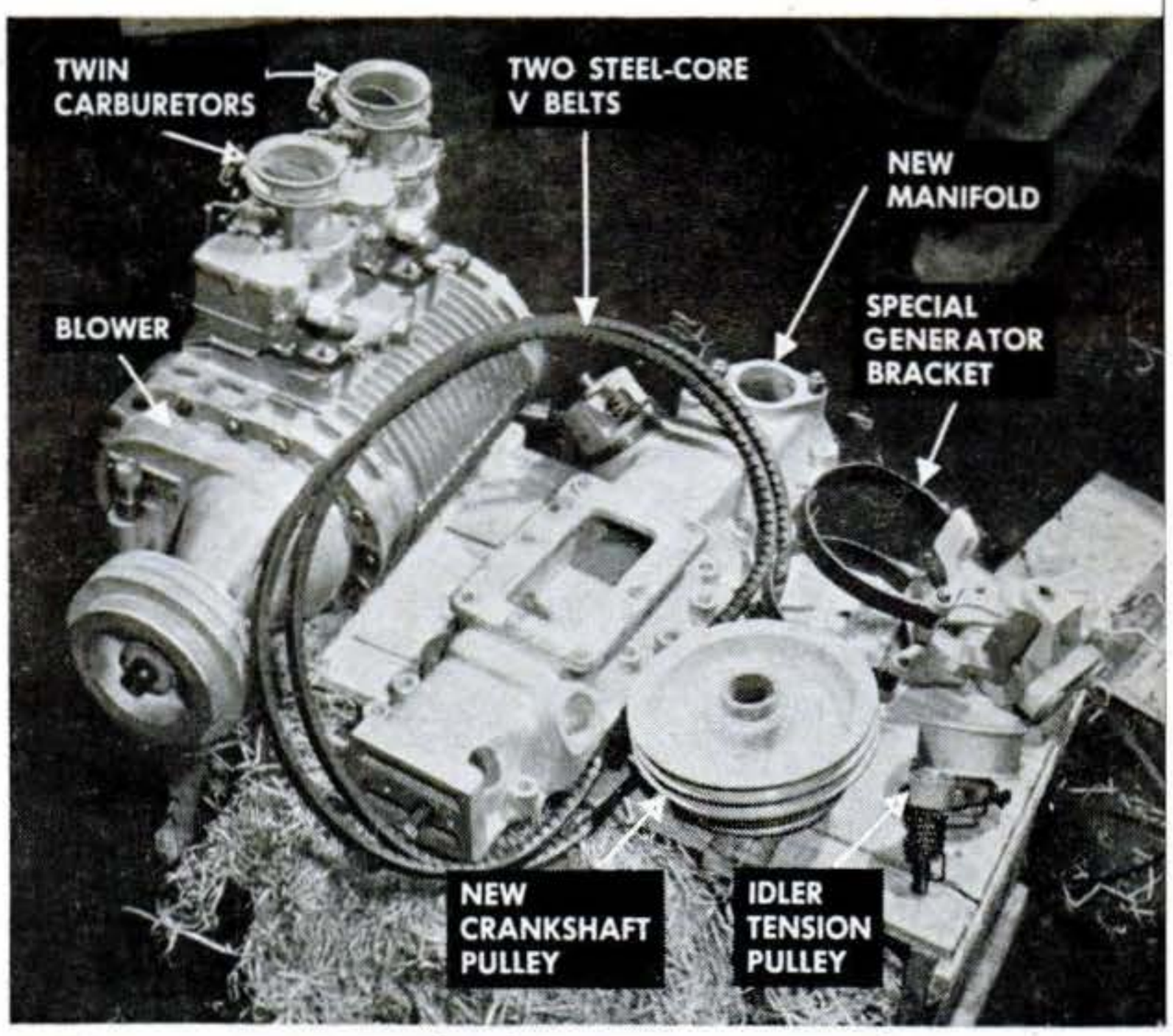
That was the report of a driver after taking his car out for the first time with a new gadget on it—a supercharger. It could be the report of anyone who comes unprepared to a supercharged engine. Putting this mechanical bellows under the hood has the same effect on a sedate family sedan that the Painkiller had on Tom Sawyer's cat—they both light out and they don't much care where. The performance change can be striking—but a motorist must change his driving habits to go with it.

Kits Replace Custom Jobs

Until recently, superchargers interested only hot-rod enthusiasts. Blowers had been around since the 1889 Daimler, but you could have a supercharged American car in recent years only by ordering a custom blower for your model. Now kits are being made for a number of stock cars. Any good mechanic can put one on in a day.

What is a supercharger? Essentially it's just an air blower. It takes the fuel-air mixture from the carburetor and blows it into the cylinder under pressure, instead of leaving it to be sucked in by the intake stroke of the piston. Thus you obtain a greater weight of fuel mixture in the cylinder. To put it differently, the pressure of the mixture inside the cylinder has been increased by two-stage compression—once by the supercharger, once by the compression stroke

Italmeccanica supercharger kit is unpacked by Jim Pauley of Sportscar Enterprises, Banksville, N. Y. He estimates average installation cost at around $50. Kit itself costs $387.50.



1 Here are pieces of Italmeccanica supercharger kit ready to go on 1950 Mercury. Note use of two stock Ford carburetors. Kits come for Fords, Mercurys, Chevrolets, Crosleys, Studies.

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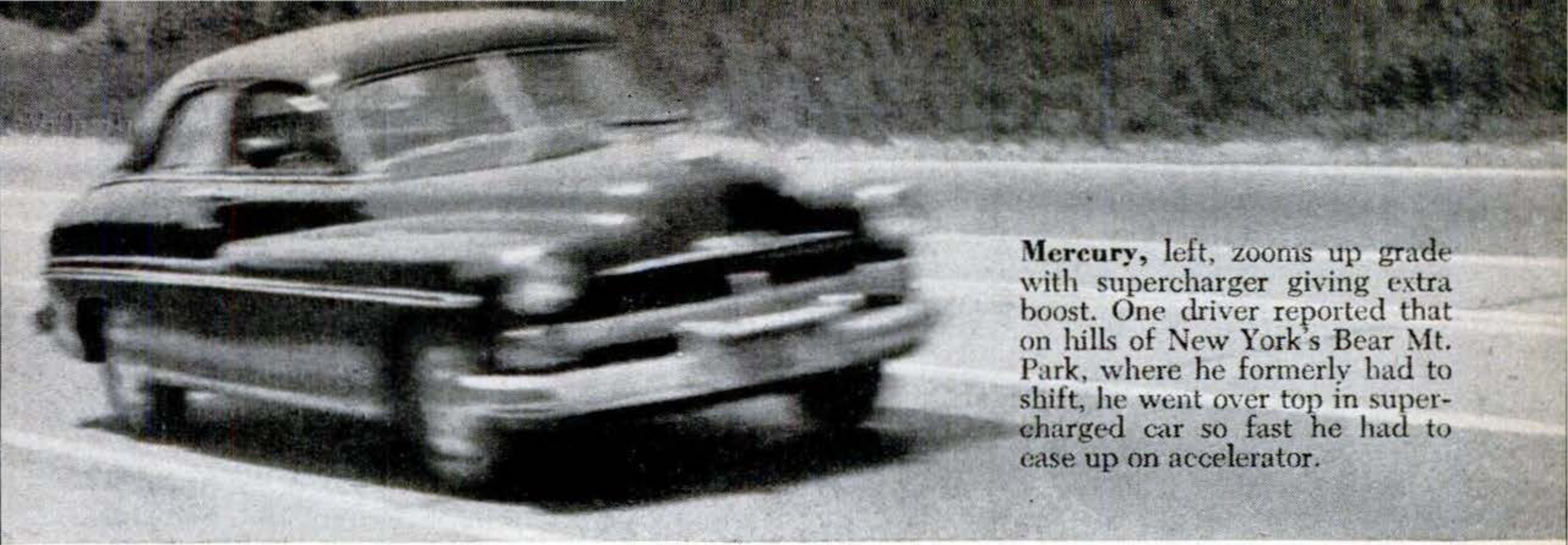


Mercury, left, zooms up grade with supercharger giving extra boost. One driver reported that on hills of New York's Bear Mt. Park, where he formerly had to shift, he went over top in supercharged car so fast he had to ease up on accelerator.

of the piston. In effect, the supercharger increases compression ratio. But how much? Well, the theoretical boost can be figured by multiplying the compression of the supercharger by the original compression ratio. If the supercharger compresses the fuel mixture 1.5 and the original ratio is 7 to 1, then the result is equivalent to increasing the compression ratio to 10.5 to 1.

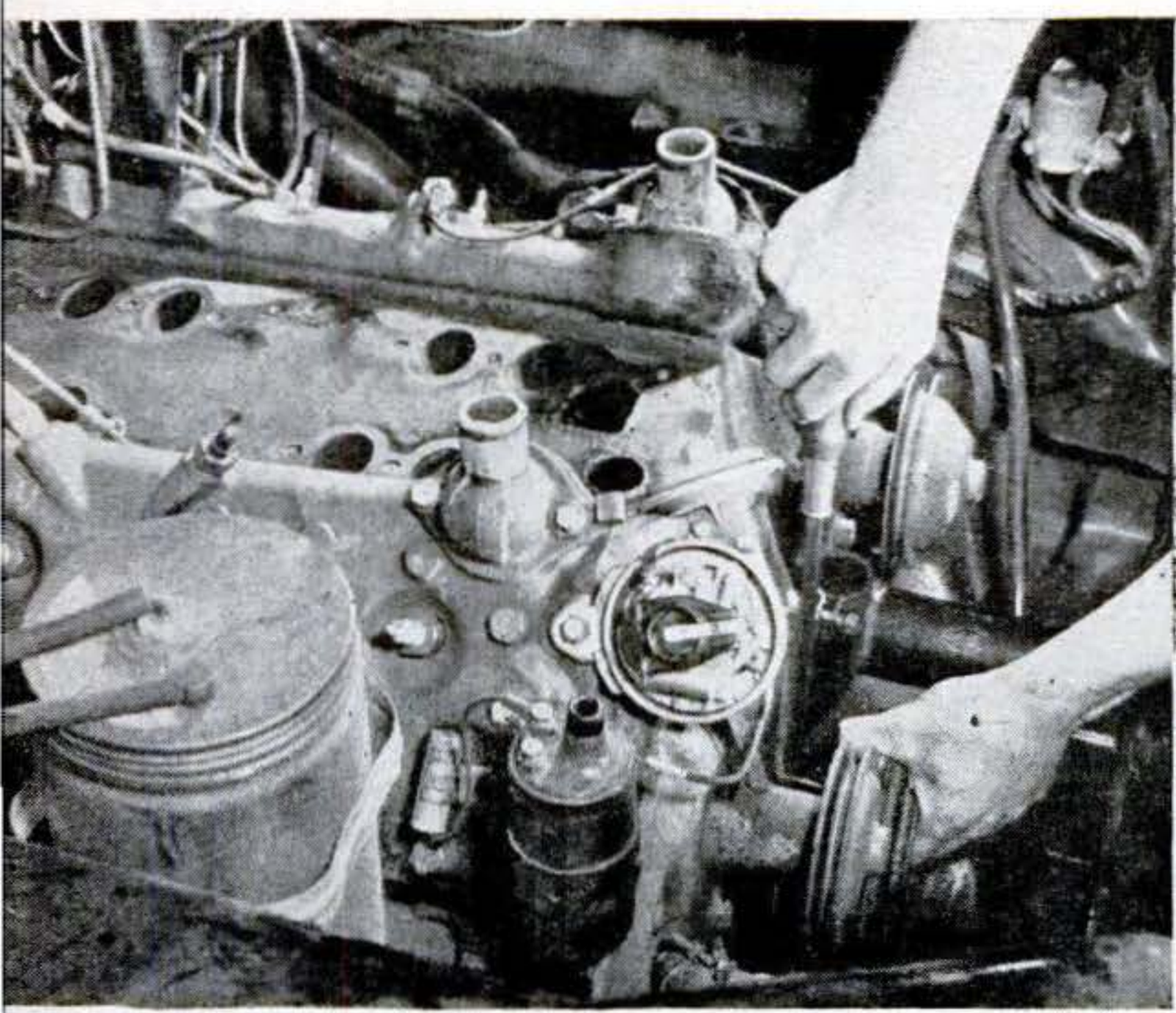
Boosts Power Up to 85 Percent

The boost in horsepower should be—theoretically—in the same ratio as the boost the supercharger gives the manifold pressure. If the increase is 8 pounds over the original atmospheric pressure of 14.5, then the horsepower increase should be on a ratio of 22.5 to 14.5, or roughly 3 to 2. Actually, it will be considerably less. Ignition lag, and heating of the charge by the supercharger, will cut down efficiency. Besides, the supercharger itself eats up several horsepower.

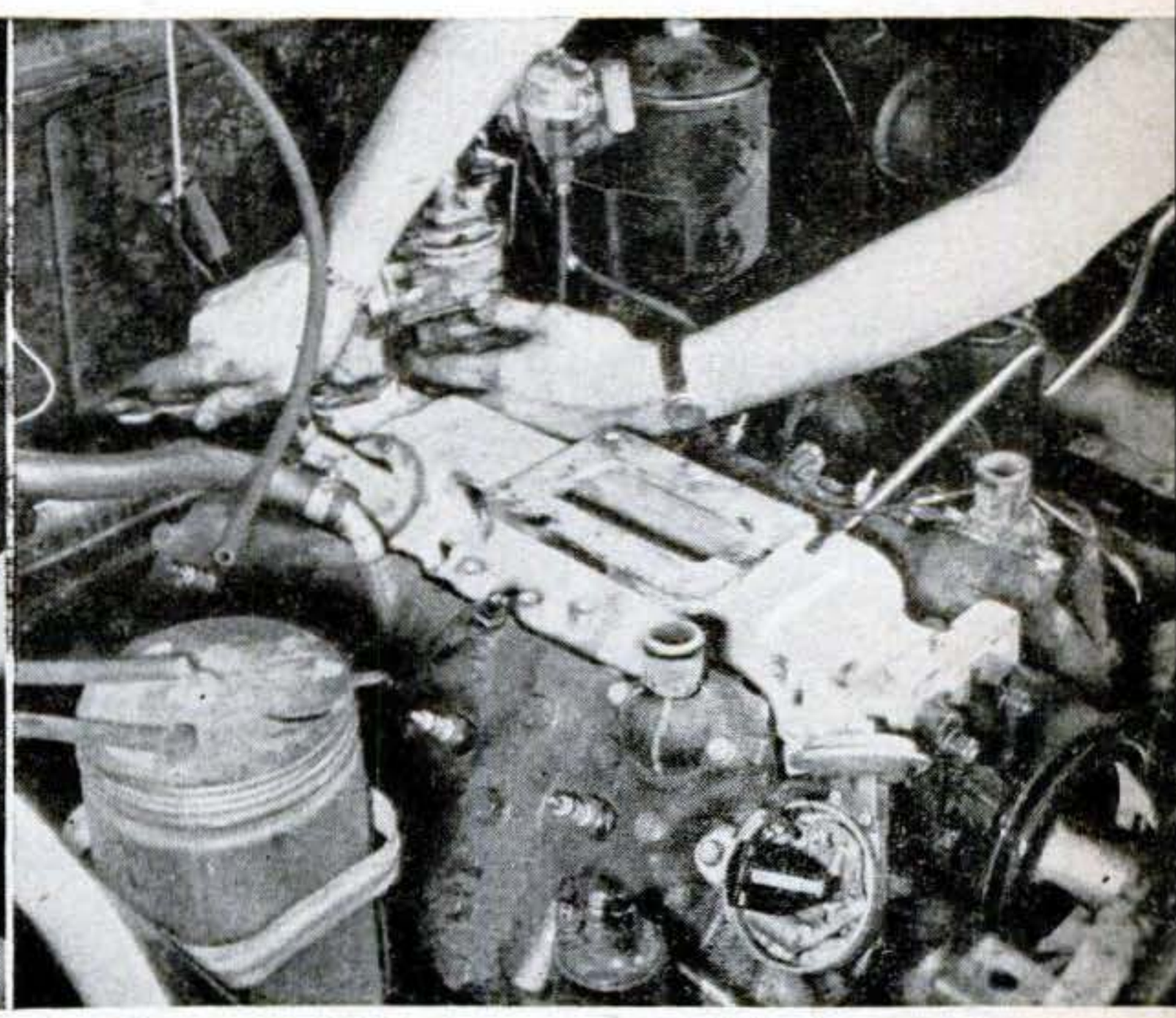
The power gain primarily results from the higher pressure within the cylinder. But the better mixture of fuel and air that a supercharger gives helps, too. So does the even charge blown into each cylinder regardless of minor variations in piston speed or timing.

Kits now on the market represent the two principal types of blowers. The Frenzel, made in Denver, is a centrifugal type, which hurls the air around and lets it fly, like a slingshot. It is said to give approximately a 40-percent horsepower increase at about 3,750 r.p.m.

The Italmeccanica blower, imported from Italy, is a positive-displacement blower of the Rootes type. It traps the air-fuel mixture between intermeshing rotors in a housing



2 New crankshaft pulley is first step. Radiator, battery, air filter, carburetor, manifold, fan assembly, fuel pump, and old crankshaft pulley have all been taken off at the outset.



3 New manifold is now on, and fuel pump is bolted to it. Just below mech's right wrist is blow-off valve that relieves pressure in case of backfire, preventing damage to blower.

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and pushes it out. The power increase is reported to run between 48 and 85 percent.

I talked to a number of drivers who had recently handled cars with an Italmeccanica installed. A big boost in power was the first thing mentioned by all of them. There was general agreement that whatever gear you were in, you got at least the power of the next lower gear—without, of course, a lower gear's speed ceiling. All the drivers reported pulling away from such hot jobs as the Olds 88 and 98 and fishtail Caddies.

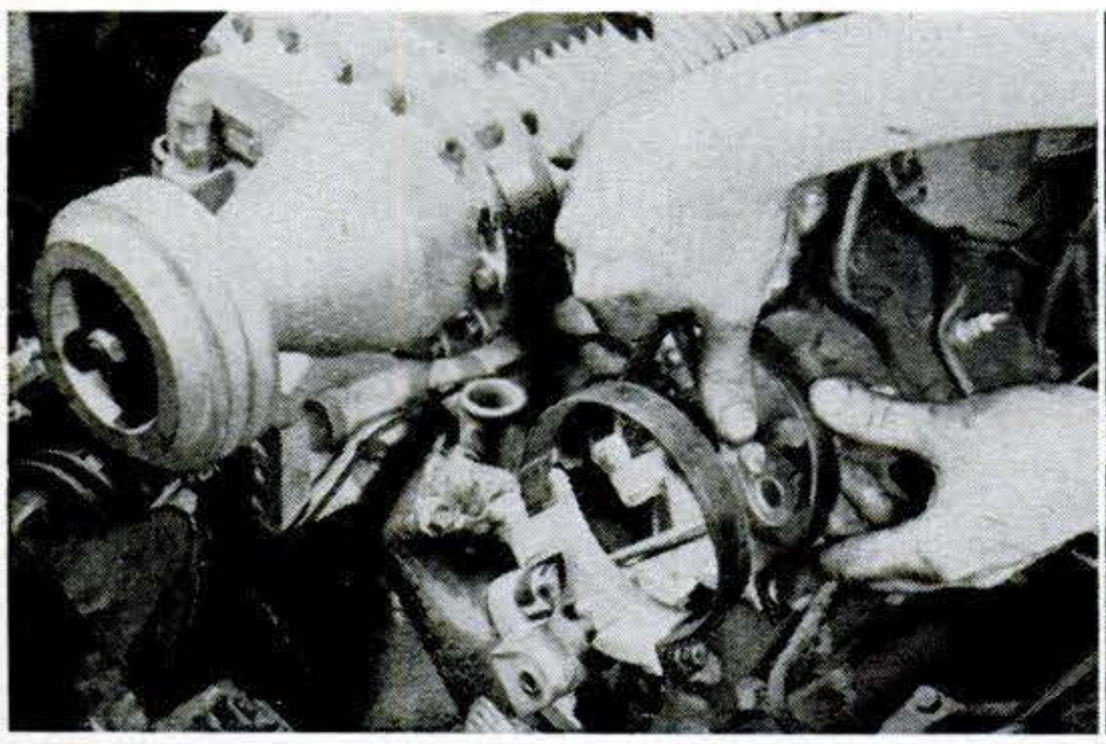
"Really Kicks Its Heels"

As one driver put it: "Beginning at 35 to 40 m.p.h., it really kicks its heels and lets go. The faster you go, the more the supercharger seems to boost the engine. You can accelerate from 50 to 60, for instance, with the same zip that most cars give you between 35 and 45."

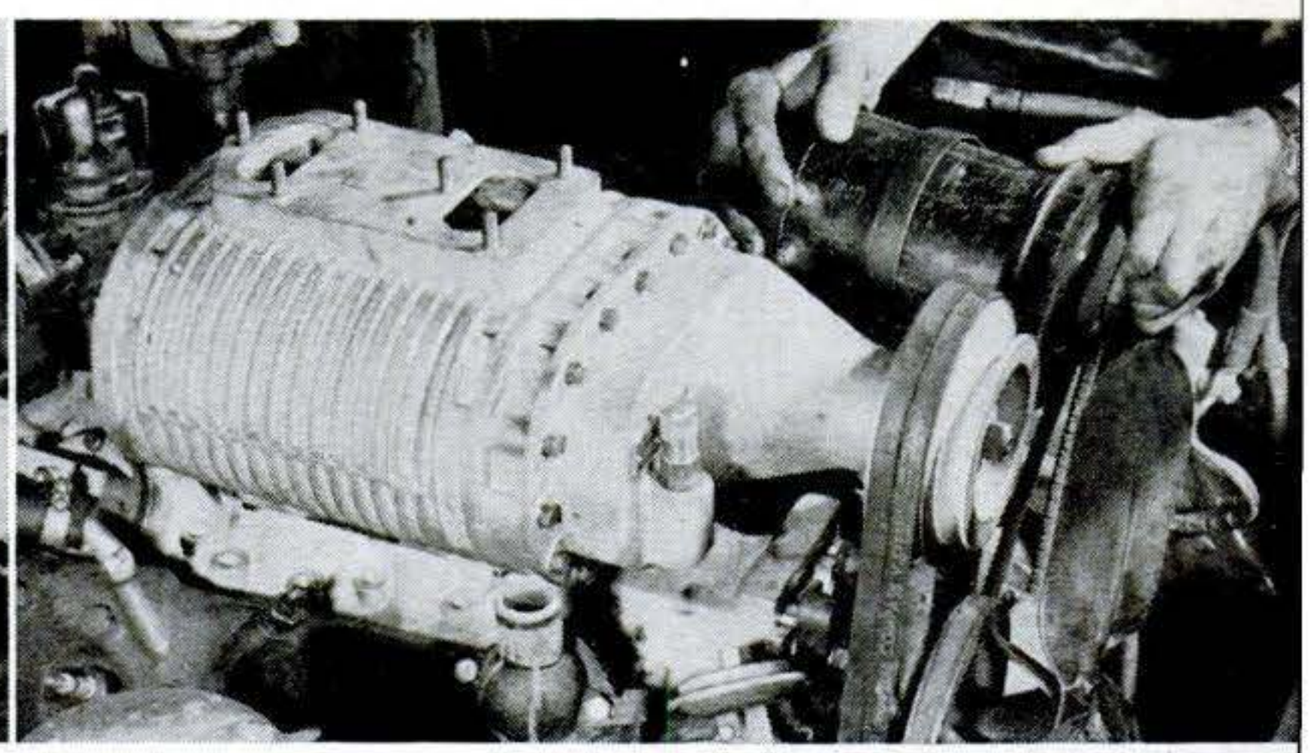
As for top speed, a driver who had found a safe and deserted stretch of four-lane highway reported doing 95 before having to slow up for a curve. "You don't have to nurse your engine up to 85 or better," he declared, "it walks right up there by itself in a hurry and there is a lot of accelerator travel left. She had at least 30 m.p.h. left at that speed."

All drivers agreed that a new sense of space-time relationships—how far you can go, how fast—is essential if a driver is to keep out of trouble. All braked more than usual at first, tending to ride up the back of the car ahead.

Outside of power performance, all the drivers found things to criticize about the supercharged car—the extent of their criticism varying with the relative importance they placed on pep and smoothness. For one thing, the supercharger was noisy, not overwhelmingly loud but insistent, particularly at low speeds. Passengers some-



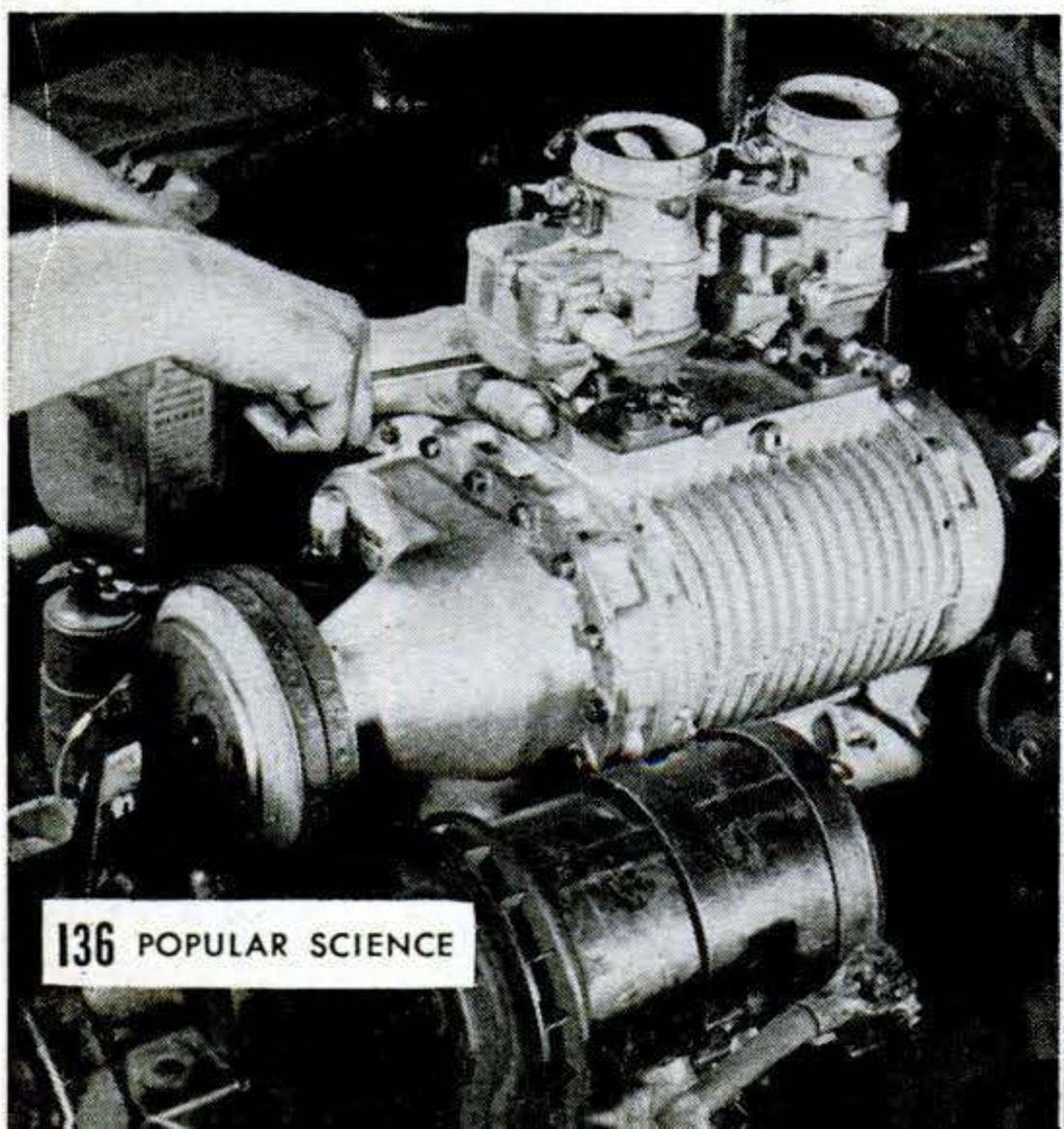
4 Blower has been installed, and new generator support is added on left of engine, where generator is moved to make room for charger.

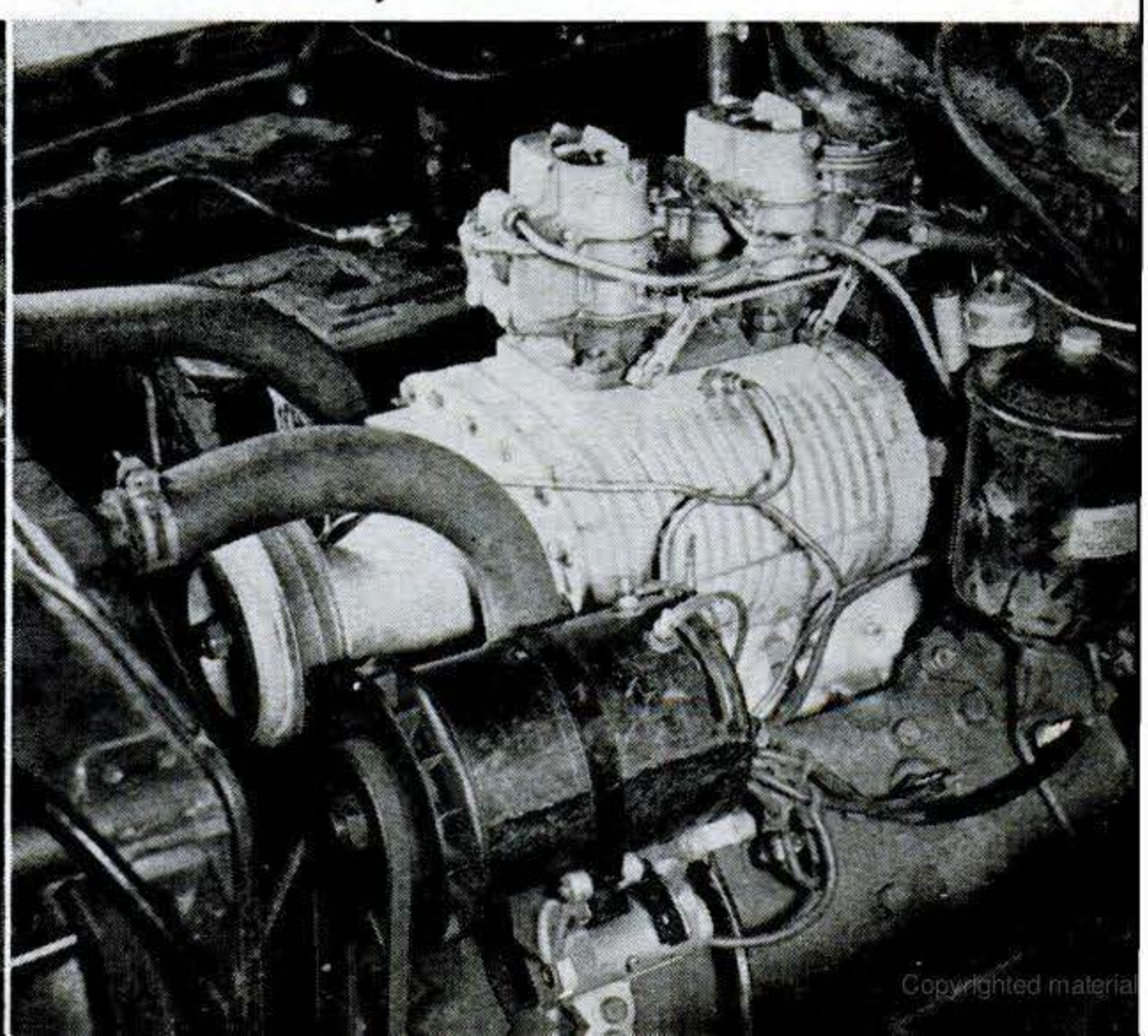


5 Belt for generator and left water pump is adjusted to pulley. Twin belts in foreground drive blower from crankshaft at 1.14-to-1 ratio.

6 Twin carburetors are now bolted atop manifold. Hole between them in base is for vacuum line from blower intake to control automatic spark advance. Manifold now has pressure instead of vacuum so it can no longer be used.

7 Completed installation. Gas line has two-way fitting so it can feed both carburetors. Carburetor throttle valves have been linked by a rod so they respond to throttle simultaneously. Note that battery has been shifted.





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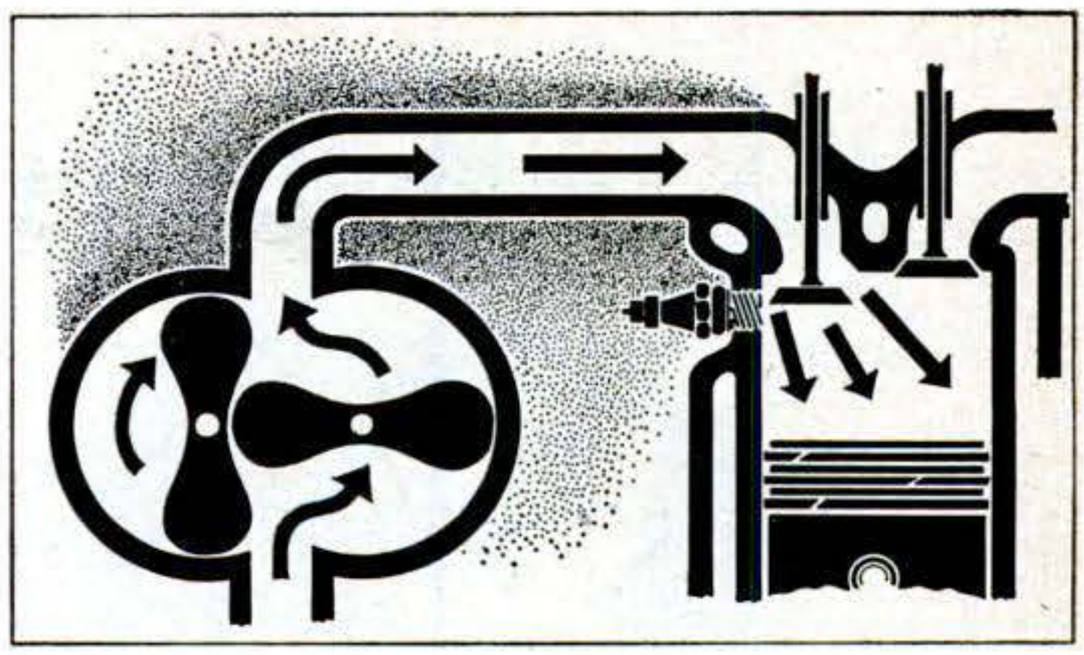
times found the sharp pick-up uncomfortable, but this was partly because the drivers were not used to it.

As for gasoline consumption, these drivers reported a small but definite increase. Whether this was due to the supercharger itself, or to the different kind of driving it encouraged—fast starts, bursts of speed—was not clear. Experts themselves differ as to whether the supercharger itself increases gasoline consumption.



Rootes type of positive-displacement blower is shown schematically above. Rotors revolve in opposite directions each carrying fuel mixture. At exit, intermeshing action of rotors forces out mixture. Since each rotor revolution pumps nearly same volume regardless of r.p.m., blower loses little efficiency at low speeds, is well suited to variable speeds of ordinary driving.

You Pay a Price for Power

When you come to consider the long-term effects on a car, there is probably increased wear. And there can be no question but that a supercharger increases the load on engine blocks, main bearings, gaskets, and spark plugs. For this reason, Italmeccanica makes no kits for some stock cars that do not have enough margin of extra strength to take the stresses.

All in all, whether or not you want a supercharger would seem to depend on what you like best in a car—flashing power or conservative performance with maximum economy. If the former, you'll like it.

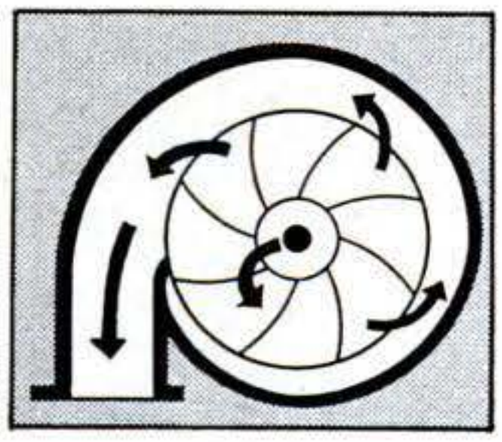
There's a possibility that superchargers may loom larger on the American automobile scene, for they seem to offer some assets of high compression without its liabilities. The catch in high compression ratios is that in most engines they heat up the mixture in a cylinder so that it tends to ignite prematurely, producing a ping that is at best annoying and at worst can wreck the engine. To avoid this ping, higher-octane gasoline must be used. As compression ratios climb, oil-company engineers are definitely unhappy about the tremendous investment in high-octane refining plants that higher ratios will necessitate.

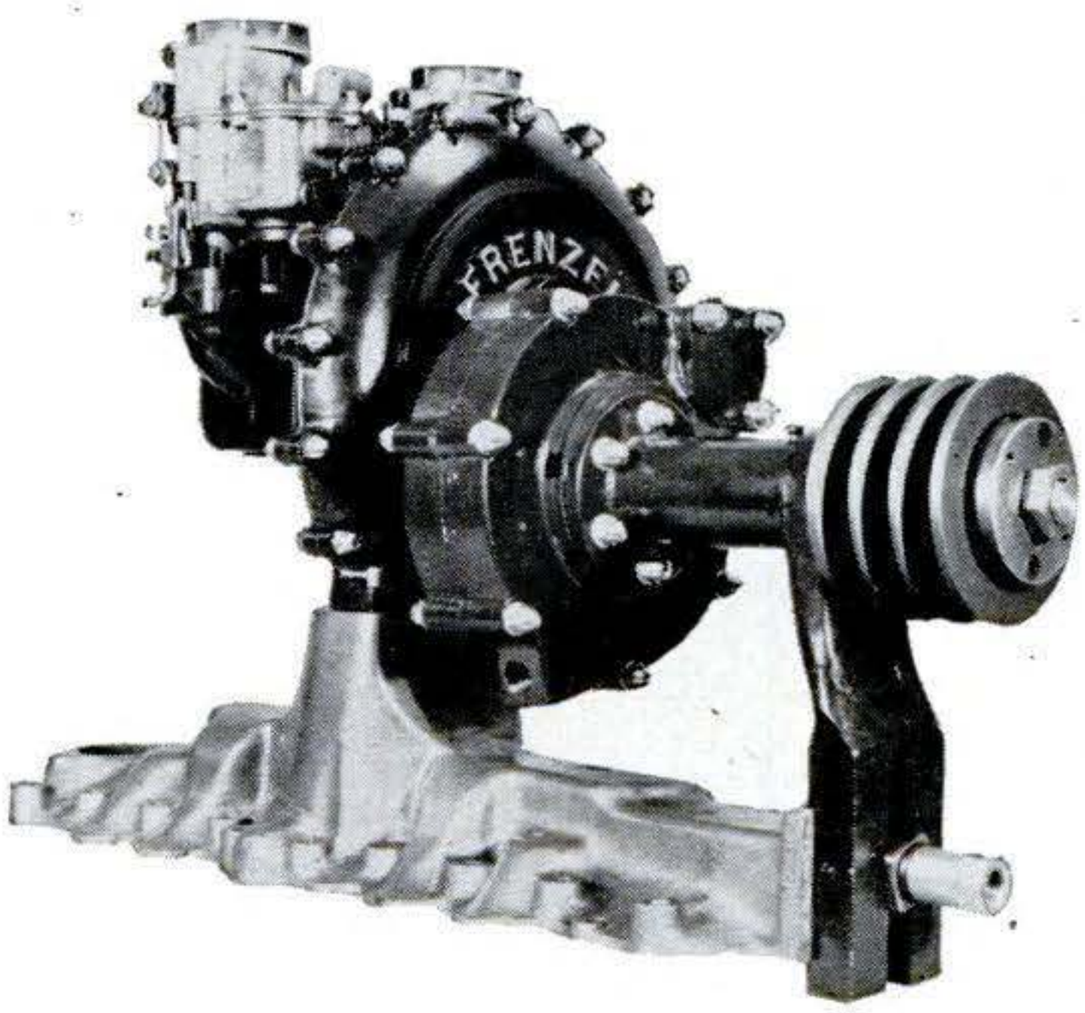
High Performance Without High Octanes

So some of them are looking at the supercharger for an out. Since it compresses the gas-vapor mixture partially outside the cylinder, the mixture loses some of its heat before it reaches the cylinder. What's more, a cooler can be installed between the blower and the manifold to reduce the temperature of the supercharged mixture reaching the cylinder. This has already been done experimentally, lowering the temperature as much as 60 degrees. That would give you really high performance without high octanes.

So someday you may be driving a car with a supercharger, even if you don't know the difference between a hot rod and a hot foot. **END**

How centrifugal supercharger whirls air and lets it fly is shown in schematic drawing at right below. In general, centrifugal blowers move less air per revolution at low r.p.m.s than at high, thus are less efficient at low speeds and best suited to steady fast driving. Photograph below left shows Frenzel centrifugal blower. Air is pulled from carburetors, rear, and blown into manifold, below. Cast-aluminum impeller turns about six times as fast as crankshaft. Manifold pressure is boosted six pounds at 4,200 r.p.m. Frenzel makes kits for Ford and Mercury models from 1939 through 1948. Kits cost $183.75 F. O. B. Denver.





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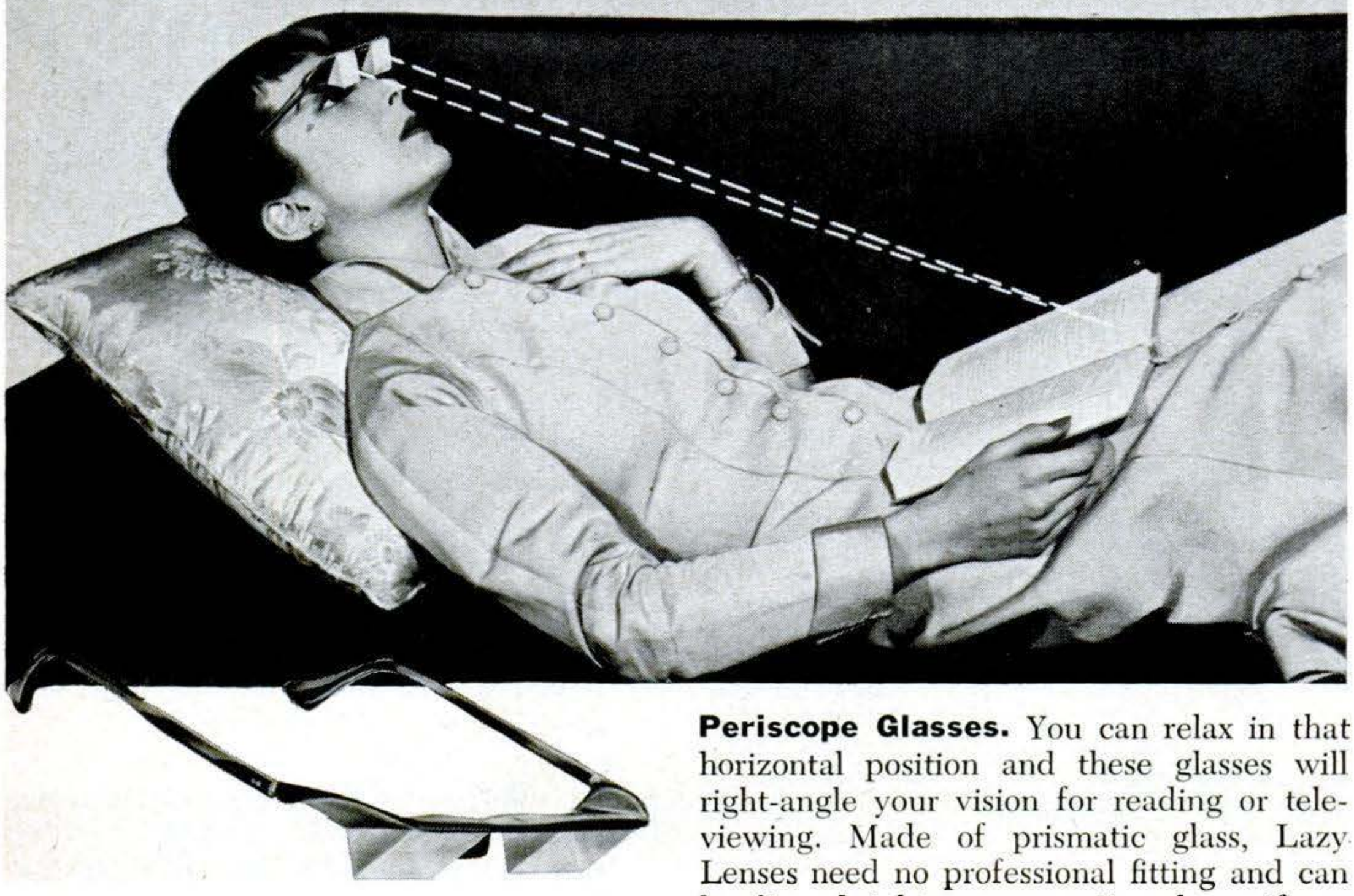
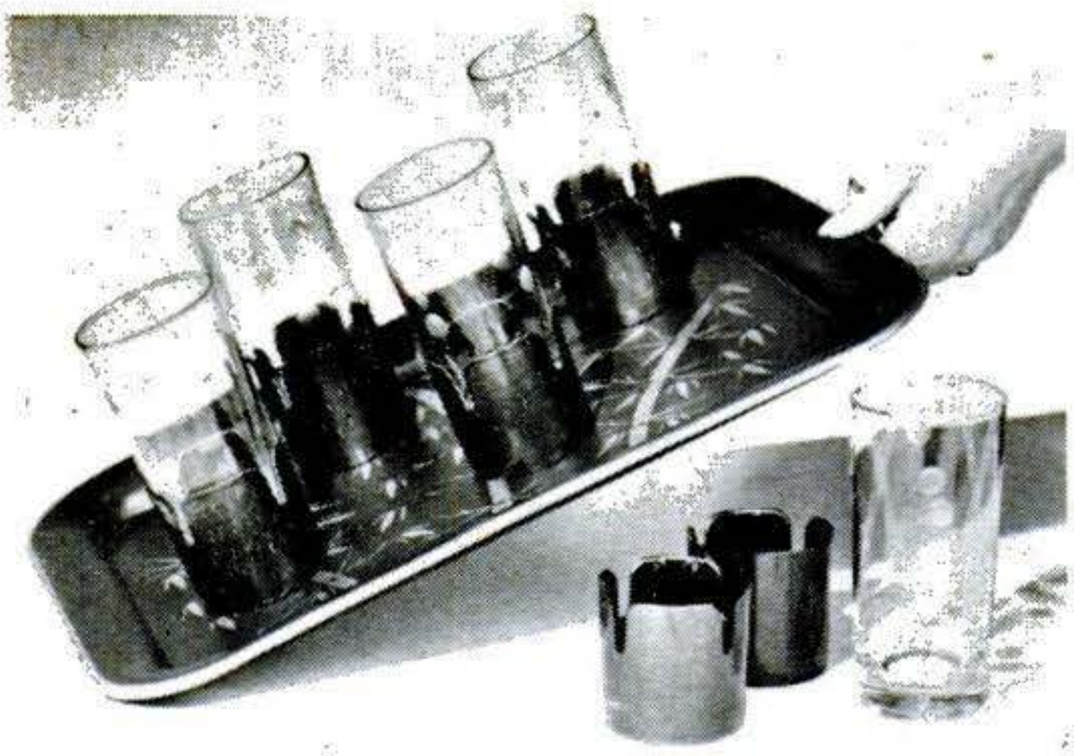
Aids to Modern Living



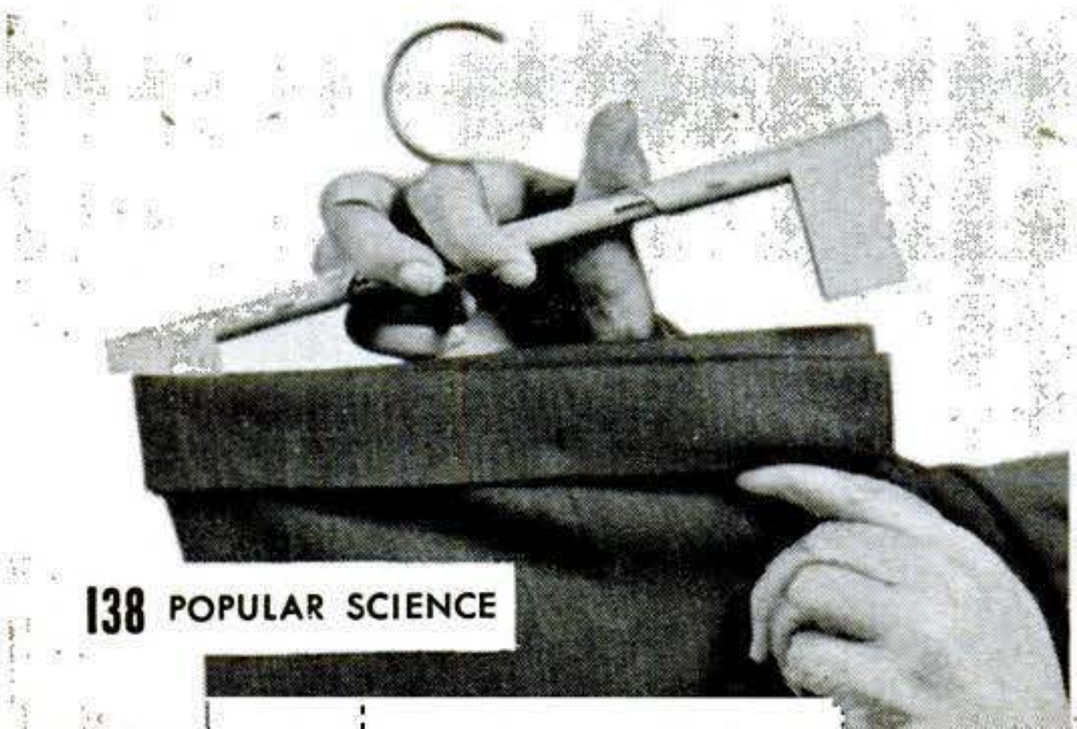
Periscope Glasses. You can relax in that horizontal position and these glasses will right-angle your vision for reading or tele-viewing. Made of prismatic glass, Lazy Lenses need no professional fitting and can be slipped right over corrective glasses if you wear them. Side pieces can be adjusted for width. *Mark Cross, New York City. $19.75.*



Magnetic Tray. Juggling a tray through a roomful of people, or over bumpy ground outdoors, is less of a hazard if you serve liquid refreshments this way. Magnets concealed in the plastic coasters anchor them to the metal tray. Because jostling and tipping won't dislodge them, they're fine for children's parties, too. *Kelcey Products, Brooklyn, N.Y. $5.98.*

Quick-Clip Hanger. A built-in spring keeps tension on the telescoping arm of this hanger, re-setting the crease while your trousers hang in the closet. Hanger contracts to release trousers. *Holdapres Co., Detroit. $1.*

Medicine-Cabinet Organizer. This shelf, attached with suction cups on adjustable arms, fits any cabinet. Slots hold razor, brush, shaving cream, or toothpaste. *Modernwise Cabinet Co., Washington, D.C. Under $3.*



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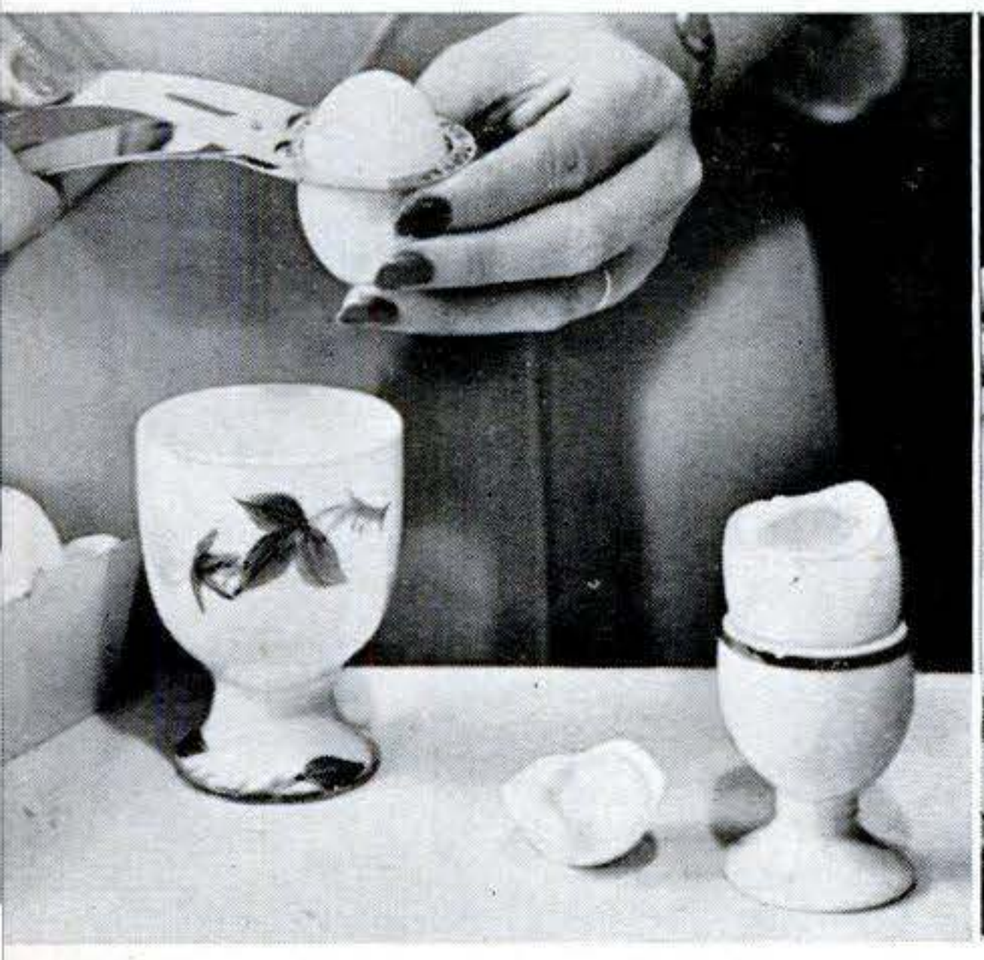
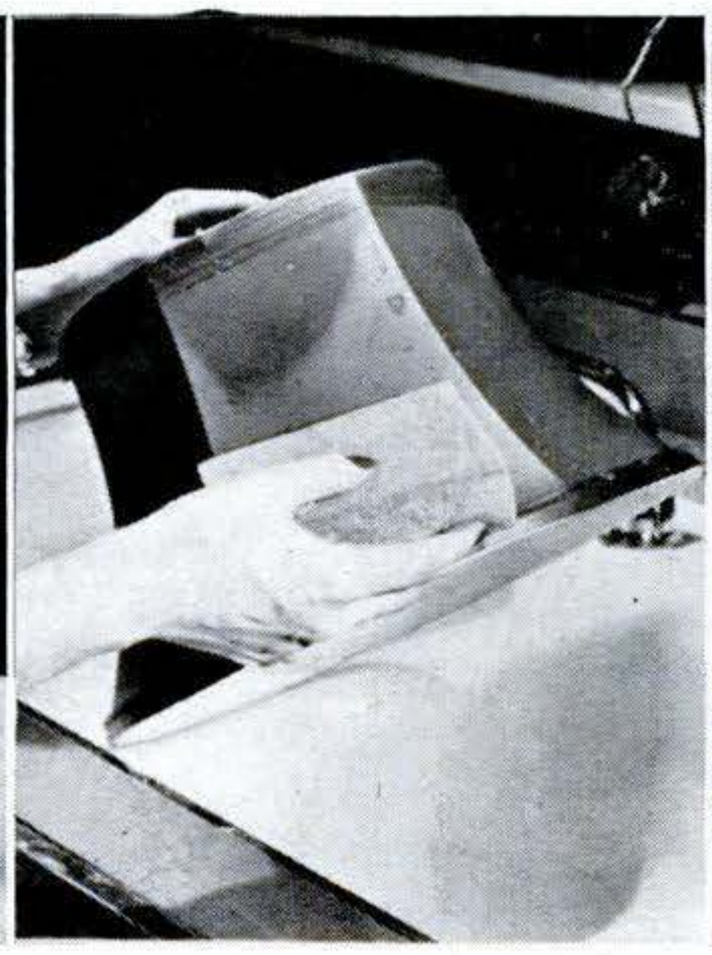
Two-in-One Oven. Some new electric stoves can do everything for the cook but buy the groceries. Two Frigidaire models have ovens that cook a roast and bake a cake at different temperatures at the same time in the same oven. A movable heating unit converts the large single oven into two separate ovens, with separate controls for each. The upper oven also serves as a broiler. Move the center section into the bottom and the two ovens again become a single giant oven.



Egg-Nipper. Slip the Egg-Topper over the egg, press the handles, and a stainless-steel blade nips through shell and membrane, lifting off the top. *Jepson Mfg. Co., Oakland, Calif. $1.*



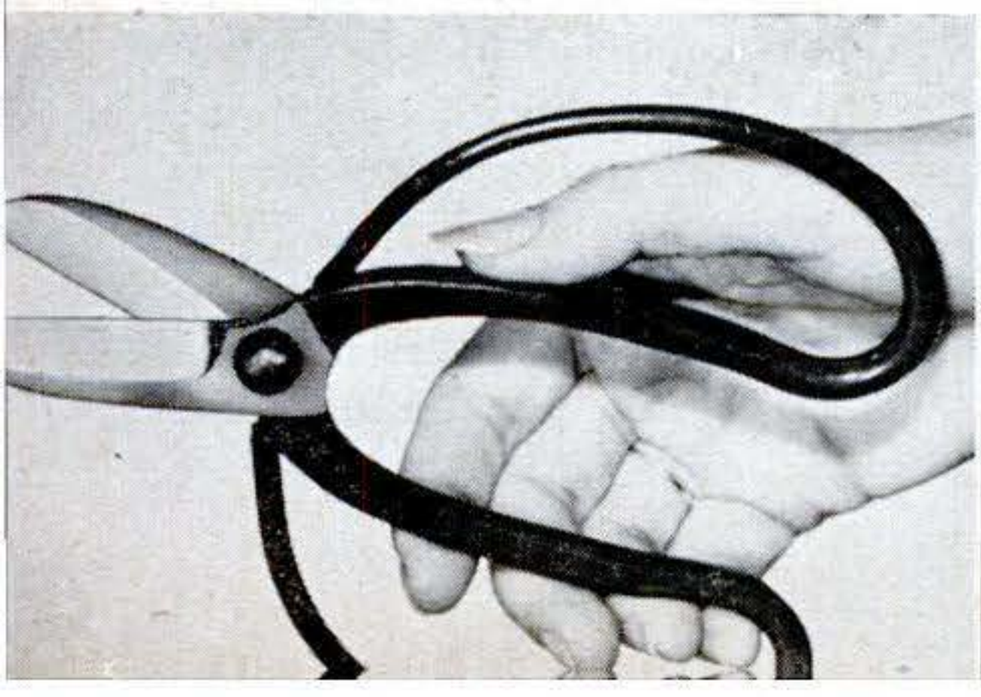
Easy-to-Clean Shade. Vinylite plastic lamp shades look and feel like silk. But they'll wipe clean with a little soap and a damp sponge. *Michael Lamp Shade Corp., New York City.*

Pipe-Cleaner Pouch. Pipe cleaners as well as tobacco are always handy in this plastic pouch. It has pockets in the flap to hold five of them. *Korey Products, New York City. $1.*

Hand-Savers. Big, comfortable handles on these garden shears give you more leverage with less pressure. *Calhawaii Co., Pasadena. $2.95.*

Rubber Keg. Ice cubes last longer in this keg, which won't dent, break, sweat, or corrode. *Village Store, Lake Placid, N.Y. $7.75.*

Shred-Catcher. Interchangeable shredders lock into the cover of this plastic catch pan. *Evernu Products, San Francisco. $2.50.*



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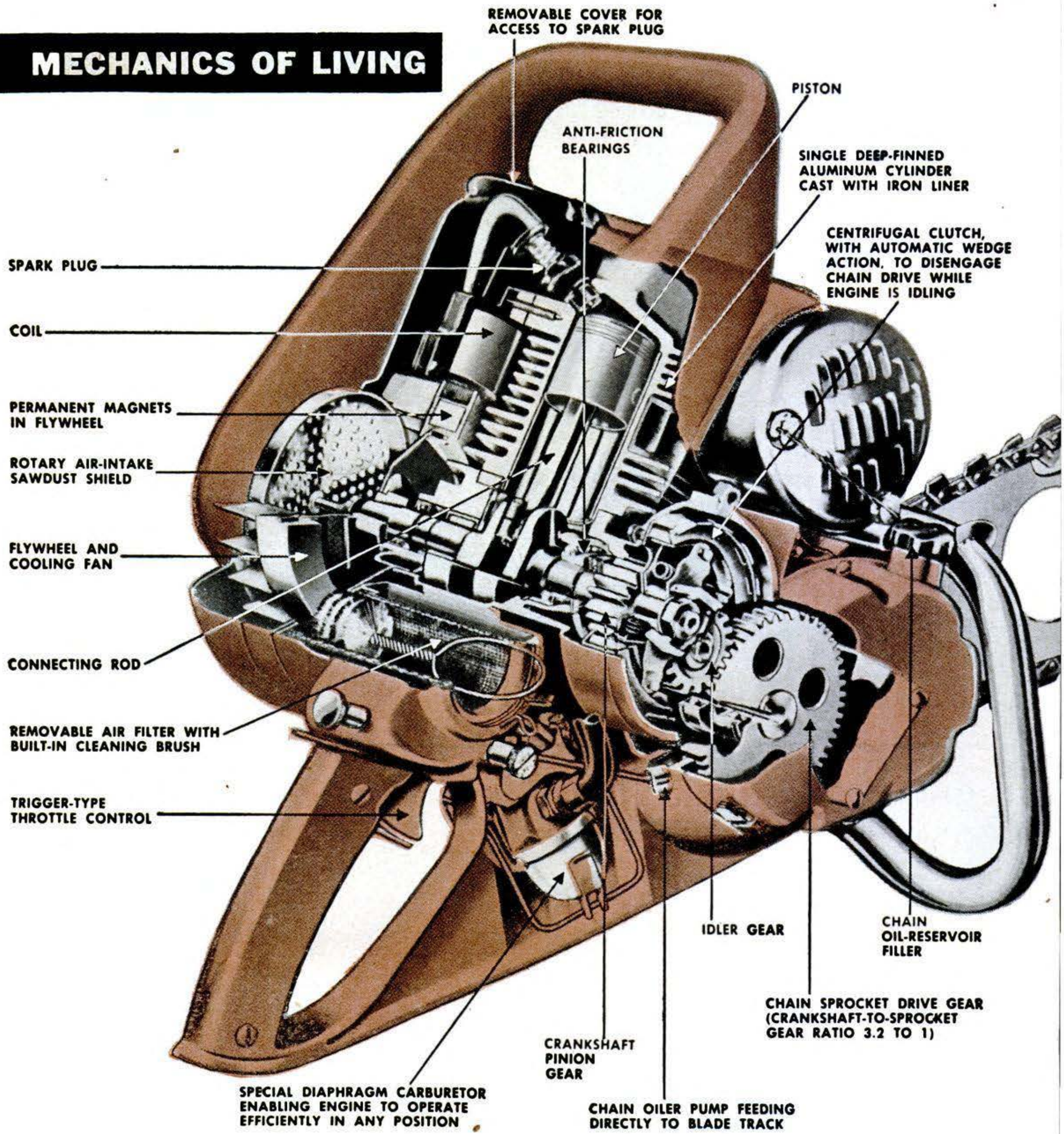

How a Chainsaw Works

IF YOU'VE ever tried to cut a tree—even a small one—you understand why woodsmen count the modern chainsaw their greatest blessing since Babe, Paul Bunyan's blue ox. You just hold on and let this motorized beaver chew its way through the tree. Already more than 200,000 chainsaws, ranging from small units that cut limbs to 12-hp. giants that fell the tall timber, are in use.

A typical model has a single-cylinder, air-cooled, two-cycle engine of three hp. A gasoline-oil mixture serves both as fuel and lubricant. Floatless carburetion permits use in any position. Since the saw cuts at full throttle, the engine warms up until, at 1,800 r.p.m., an automatic clutch engages an endless chain, whose 26 cutting teeth chew their way through the wood.

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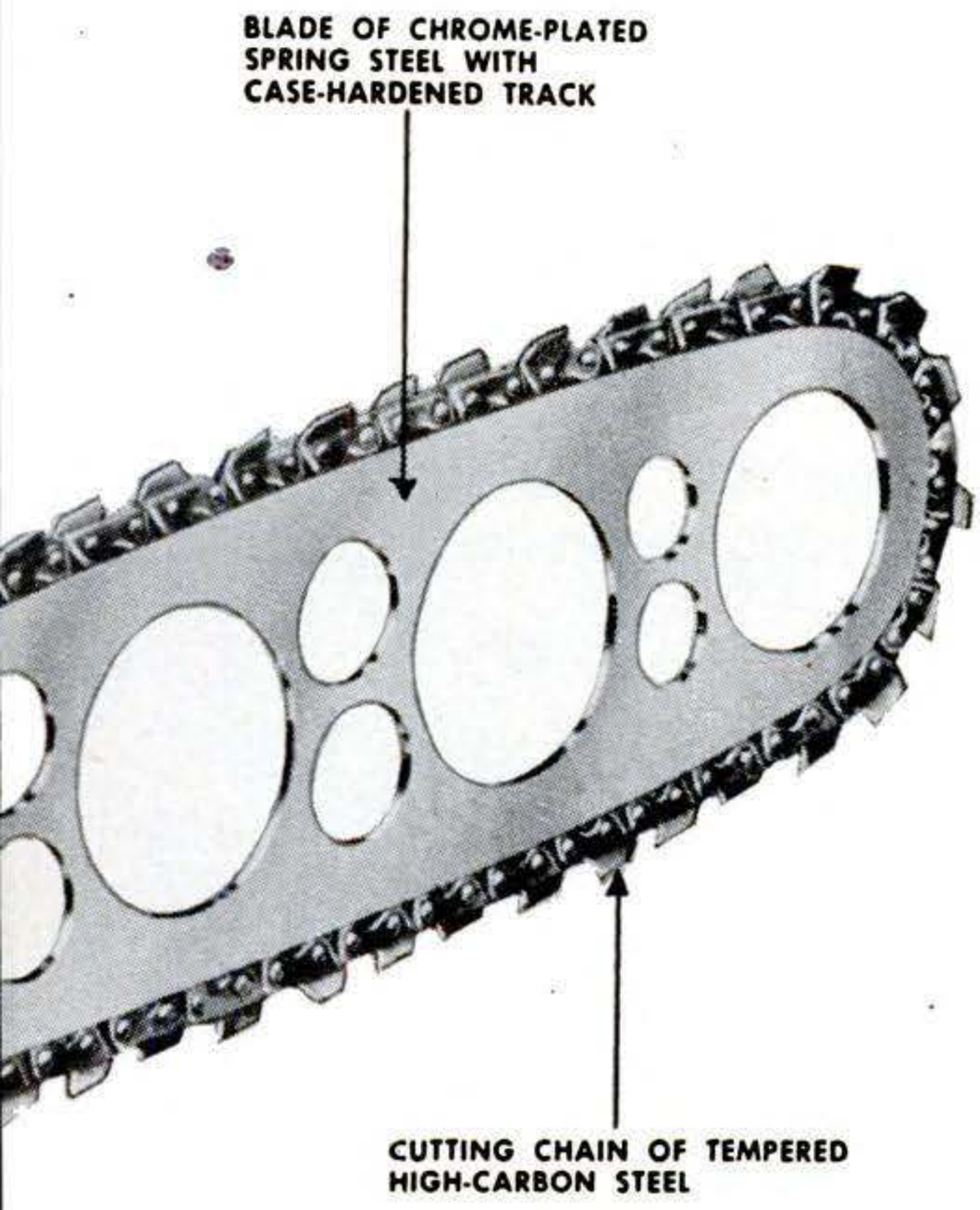
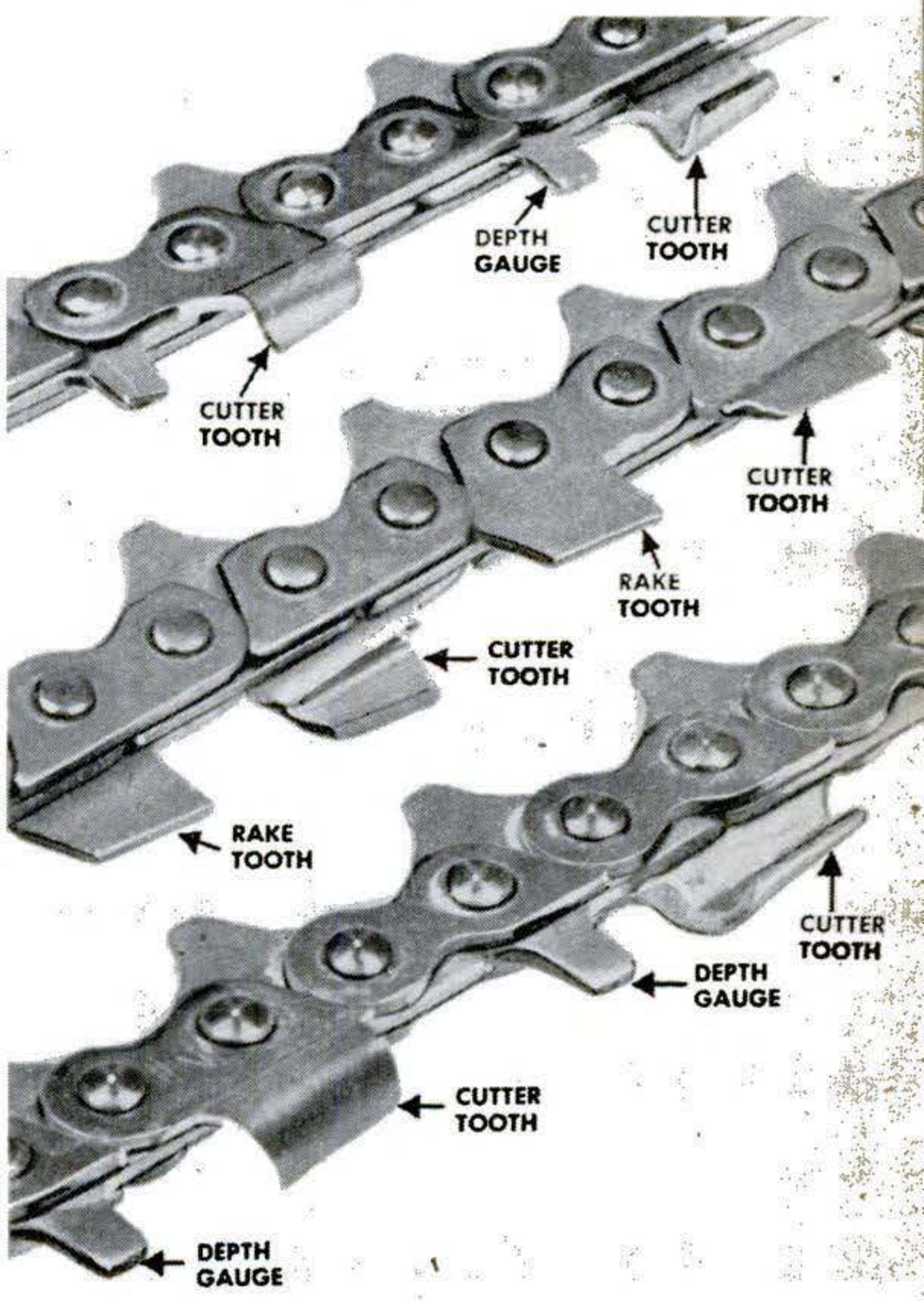


Offset blade, which saw may be adapted to use, fells trees at ground level, leaves no stumps.

Teeth rip 16-inch pine with no more effort than that of holding chainsaw in place. END

Typical chainsaw diagramed at left above, McCulloch 3-25 model, has single-cylinder engine developing three hp. It weighs 25 pounds. Here it chews through Minnesota maple.



Styles of teeth, at right, vary in three standard types of chain. Cutting teeth, flat or curved, act like chisels. Depth gauges govern amount of bite. Rake teeth sweep out shavings.

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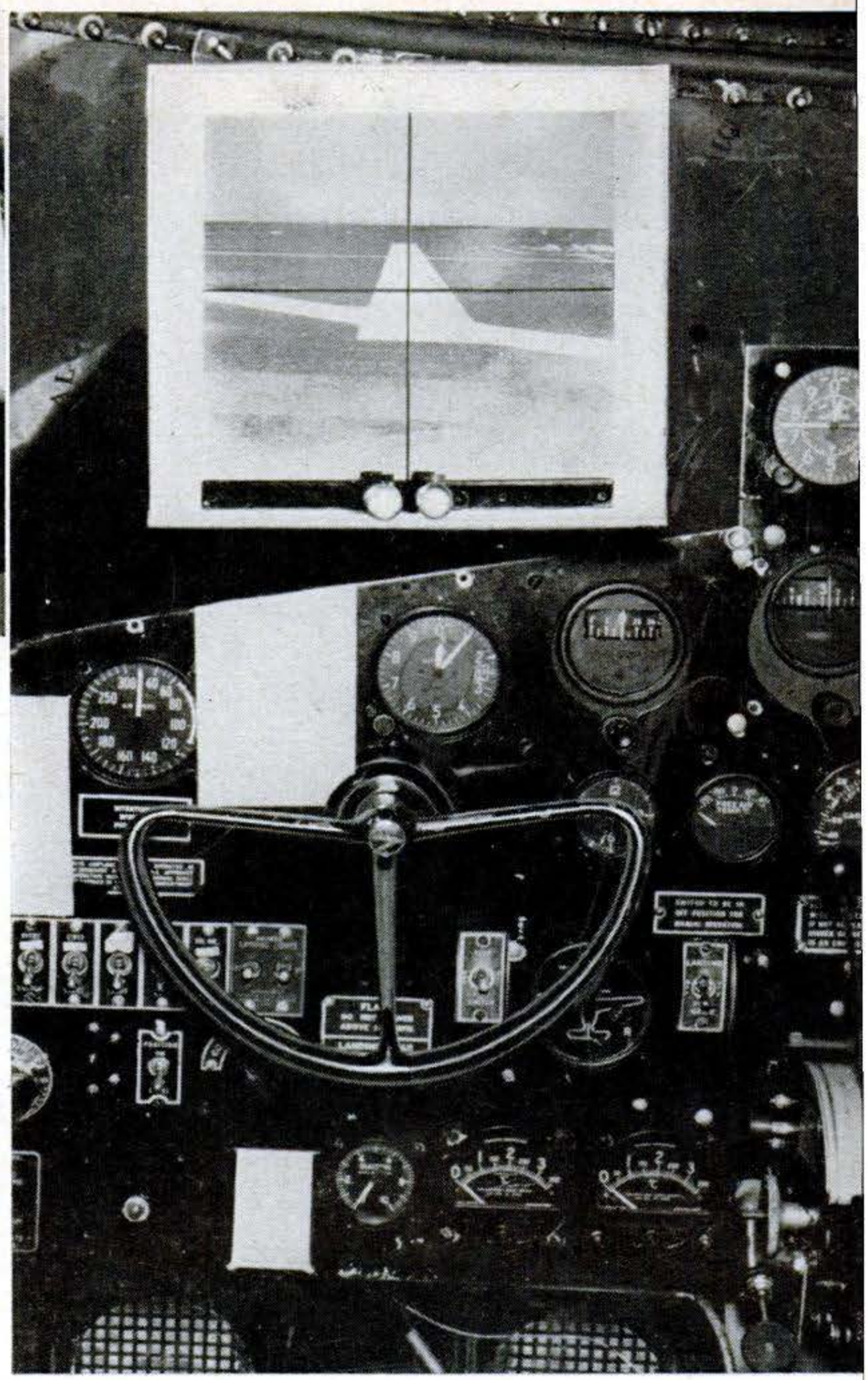

Pilot Steers by Periscope

A JET plane is about as far away from a submarine as you can get. But the commanders of both may soon be looking out at the world the same way—through periscopes. The jet pilot may need a 'scope because his streamlined supersonic craft is likely to have no room for a windshield.

The University of Illinois is already testing flights with a periscope. That's what pokes out of the blindfolded Cessna T-50 above. It creates an image above the instrument panel inside the plane (at right). The first trials indicate that a pilot can fly as well with a wide-angle periscope view on an eight-inch-square screen as he can with direct vision. Television is also being considered for this purpose.

Six-Wheel-Drive Grader Helps Seabees Build Navy Outposts

IT TAKES more than deep mud or a 50-percent grade to stop the new Navy grader below, used by Seabees to build roads and airstrips at advanced bases. A 76-hp. engine drives all its six wheels, and propels it at six forward speeds, permitting more than 15 m.p.h. on level ground. The 17,000-pound machine can fit into a big cargo plane.

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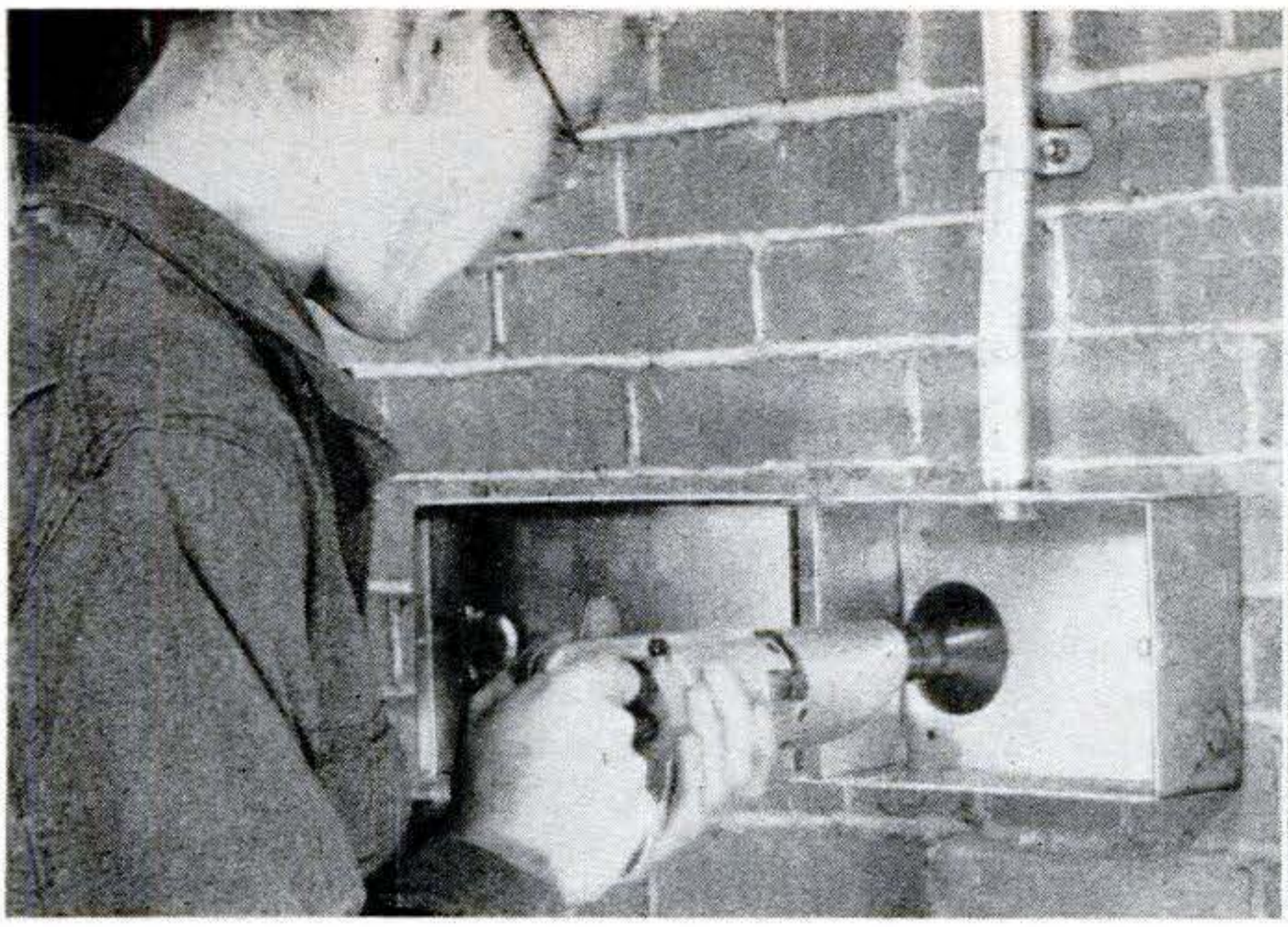
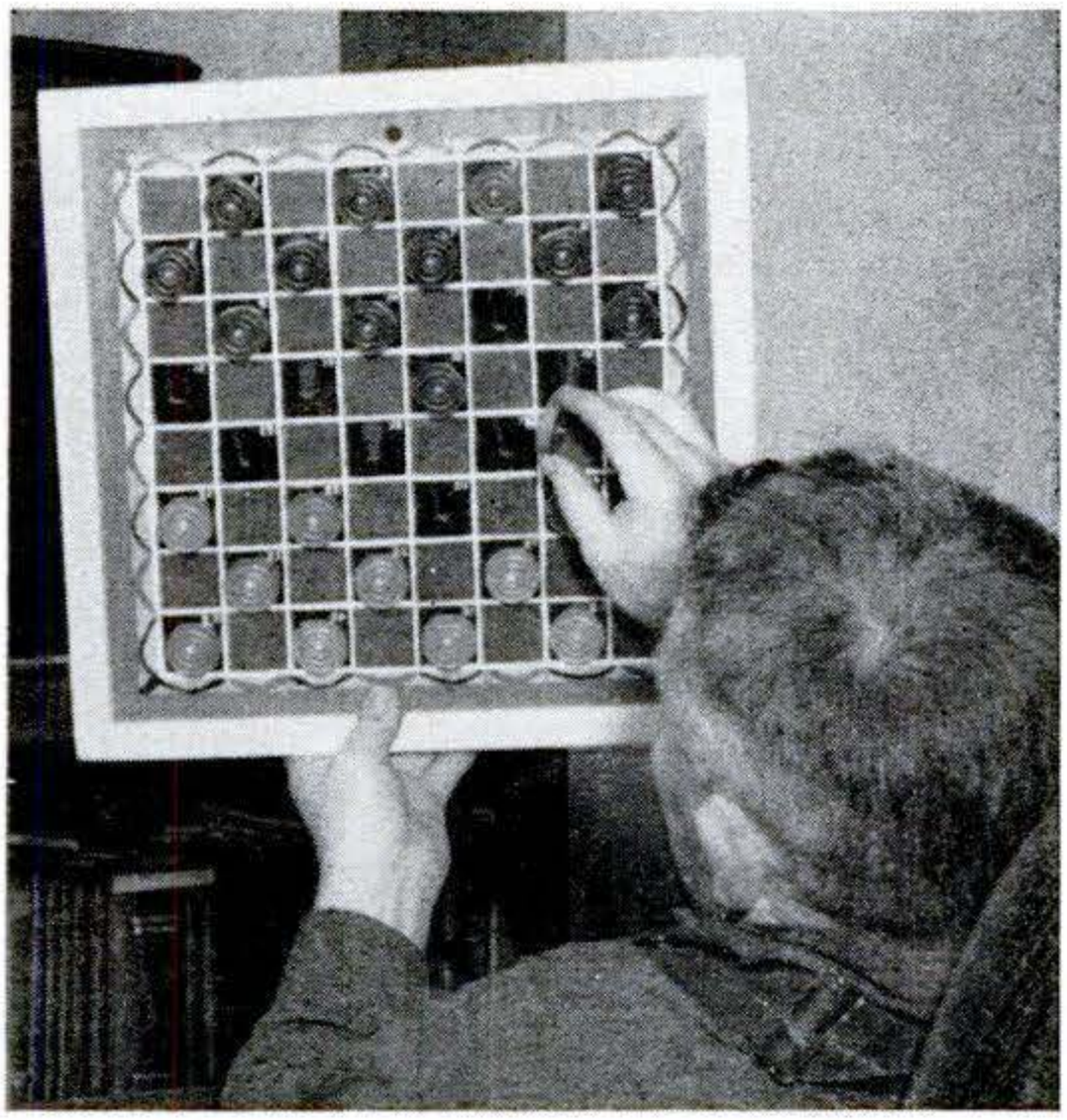


Gun Cartridges Drive Steel Studs

WITH this new stud driver, the operator carries the source of power in his pocket—32-cal. blank cartridges. Weighing less than six pounds and about the size of an electric drill, the tool drives heat-treated steel studs into steel, wood, concrete, or brick at a five-a-minute clip. That is about 50 times faster than the job can be done with hand tools.

To operate the tool, a stud is placed in a plastic-capped cartridge, and the unit is inserted in the firing chamber, as shown in photo at right above. To prevent firing by accident, a steel nose guard must first be pressed hard against the work surface and a separate safety button must be depressed. Studs come in 20 sizes. The stud gun is the first of a series of power-package tools being developed by the Remington Arms Co., of Bridgeport, Conn.



Slots Hold Checker Pieces

BLIND or bed patients can hold this checkerboard in any position—even vertically—and the pieces won't slide off. They're held on screwheads that fit into 32 keyhole slots in the playing squares on the board. The inventor, John H. Wheat, of Pueblo, Colo., also has a similar board, with slot positions in all 64 squares, for playing both chess and checkers.

Bike Takes Baby for Buggy Ride

THIS baby buggy becomes a sidecar by means of two retractable tubes attached to a plate that fits any bicycle. Pulling a handle forward over the hood of the carriage then raises all but one rear wheel off the ground so Mom can pedal merrily along while she takes Junior for an airing. The 2-fp. (footpower) Pramcar was exhibited at the British Industries Fair in London.

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P.S. Last minute news & notes...

LOOK FOR POSTPONEMENT of announcements of 1952 automobiles until late in the year or even next January. Manufacturers are postponing production decision until they know how much raw materials the Government will allow them . . . WE'VE HAD A PEEK at plans for the '52 Ford, and you're in for some surprises. The design is completely revised . . . MOST OF THE GM LINE will undergo only modifications, but Olds and Cadillac will have a much-improved automatic transmission . . . THAT HEMISPHERICAL-HEAD Chrysler engine probably will drift down into at least one of the lower-priced Chrysler Corp. cars . . . LINCOLN plans a major power improvement, but don't expect Buick to abandon its straight-eight--yet.

SWEDISH ENGINEERS go for a rowboat ride 90 feet underground when they inspect their latest oil-storage center. It's in a worked-out feldspar mine. Bottom of mine is kept filled with salt water to keep the floating oil at the desired level. Thrifty Swedes say it's cheap--and safe from bombing.

ICEBERGS should have colors like ice cream, says Oceanographer I. I. Schell. He'd spray them with bright dust to make it easier to spot, track, and count them as they move south. Practical difficulties would be great . . . SNOWSTORMS IN THE COCKPIT are hazard now faced by jet pilots. The snow falls when the air-cooling system is turned on after the outer skin of the plane has been heated by air friction. . . . THE OLD PARTY LINE may go on the air. The Rural Electrification Administration is testing radio transmission for telephone lines that are more than 10 miles from the exchange. Lower installation and maintenance costs are hoped for. PEOPLE WILL PAY for television piped into their home, claims Zenith on the basis of a 90-day test of its Phonevision. Collection of charges was 99.2 percent, although only weapon was shutting off service.

RADIOACTIVE COBALT, an isotope from atomic piles, will be used in cancer treatment. Four wafers, each less than an inch square and ⅛ inch thick, give, at a tiny fraction of the cost, the same radiation as $26,000,000 worth of radium . . . AN ARTIFICIAL MUSCLE that can actually lift 100 times its own weight has been made by Columbia biologist Teru Hayashi. Composed of actomyosin, a chemical found in all muscle, it works when reacting to ATP, another muscle chemical . . . LATEST ACTH RESEARCH, at University of Utah, gives 40 times as much of the hormone from hog glands as before . . . WIRE MESH forms "lath" backing for skin patches in new technique developed by Dr. D. L. Paulson, of Dallas. Used in windpipes and bronchial tubes, patches have saved lungs and lives.

A NEW AUTO WAX is said to wash and wax your car in the same operation--and polish it to boot. Made in St. Louis, it's called Wash n' Wax . . . "COCKTAILS" FOR AUTO ENGINES cut down cylinder wear as much as 40 percent, report U.S. Agriculture Department researchers. They fed a standard engine a 3-to-1 mixture of gasoline and alcohol and compared wear with an engine run on standard fuel.

MOLYBDENUM is latest auto lubricant. Liquid base carries fine metal particles to bearing surfaces, which are plated by molecular attraction. It's said they can't be squeezed off by any amount of heat or pressure. Advantages claimed include 10-percent r.p.m. increase at same throttle setting, better pickup, longer bearing life. Half pint lasts one oil change. Called Auto-Liqui-Moly, it's made in Great Neck, N.Y.

The Editors

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MECHANICS and HANDICRAFT
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How to Build a Concrete-Block Garage

PART 1

New masonry units are modern, firesafe, and widely available. You don't need special tools or skills to build with them.

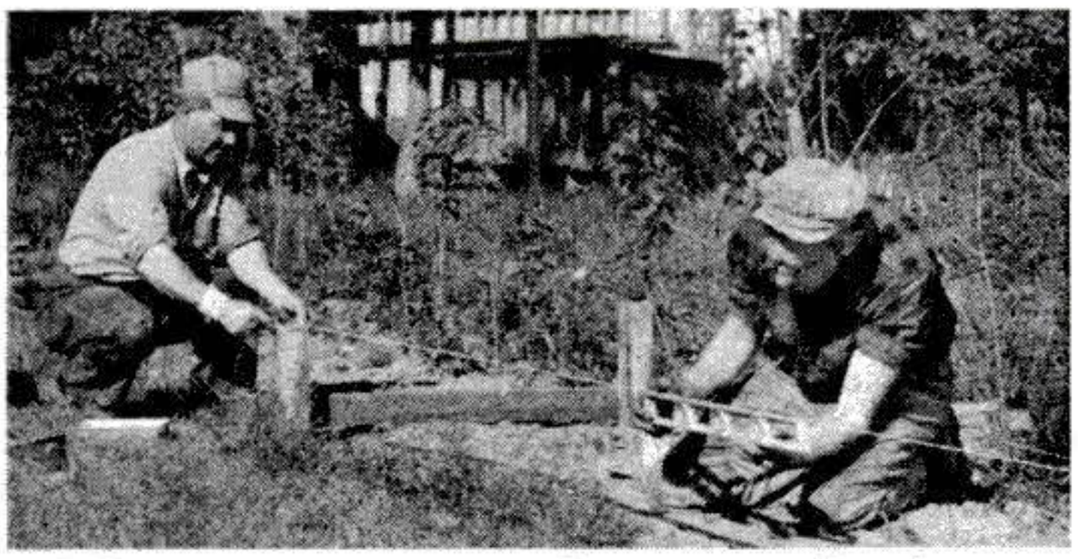
By Denis Sneigr

IF YOU are one of the thousands who bought a garage-less home to hold the cost down, here's just what you're looking for—a good-looking, fireproof garage that you can build yourself. And the price tag is attractive, too. All the materials that went into this 14′8″ by 21′4″ building cost about $650. If it had been built by a contractor, the price would have been about $400 more.

There's plenty of room for garden tools

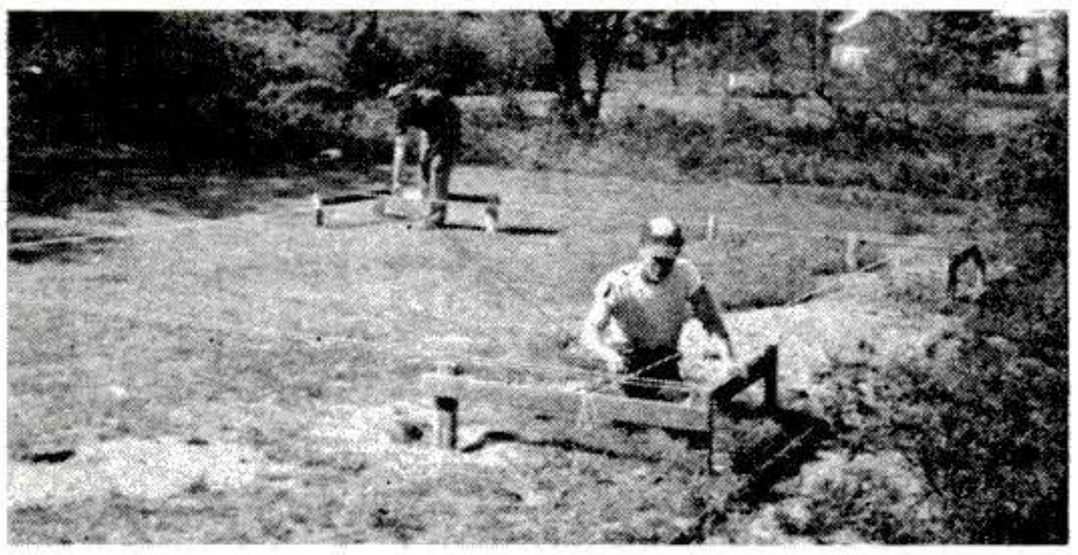
Completed garage houses car with plenty of spare room for workshop along side. Note how lines of slope-faced shadow blocks give clapboard effect. Building time is six weekends.

Setting up batter boards is first step. Three stakes are driven into ground and batter boards nailed to them. Use level to make sure boards are level. Use square to set boards at right angles to each other. Build batter boards in one corner; locate others by measuring from it.



All batter boards must be at same level. One end of chalk line is tied to first batter board. While one man checks with level (above) helper moves free end of line up and down on stake until line is level. Stake is marked and batter boards are nailed to stakes at that level. Batter boards then are set up in other two corners by measuring and checking level of lines between them and boards in first two corners.

Lines that connect batter boards must be square with each other. Corner is being checked (left) with framing square. These lines designate outside of footings. Other two lines will be added. Center line will show outside of wall. Inside line will show inside of footing.



After lines are set, final check is made (above) with steel tape. Measure diagonally between corners of lines, not between boards. Distance between each pair of diagonal corners must be the same. Then layout is square.

and a workbench. With the side door, it's easy to carry tools out without opening the big door. For good lighting, the window is in a side wall right over the best spot for a workbench.

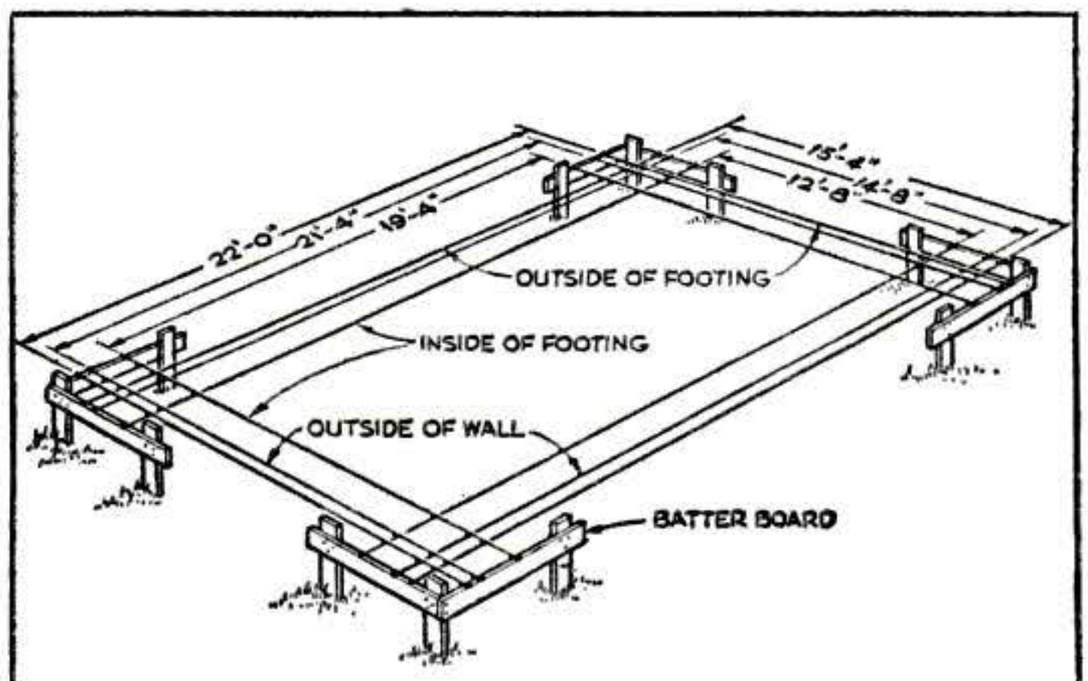
Even if you already have a garage, this building would make a dream workshop. A shop housed in such a building would be quiet, clean, spacious, and it would get you out of the cellar.

Building with concrete blocks is no more difficult than building with lumber. In some respects it's easier. You can put up a garage like this yourself, provided you can do the following:

- Bring to the job ordinary—not special—handyman skills. If you can lay a concrete walk, build an outdoor fireplace, or reroof a henhouse, you can build this garage.
- Get—if you don't already own them—such standard tools as shovel, trowel, wheelbarrow, hoe, level, handsaw, chisel, hammer, hacksaw.
- Spend six full week ends at work, and find a helper to do the same.
- Allot about $650 for the job, of which $73 is for cement and mortar, $85 for sand and gravel, and $145 for concrete blocks. That leaves about $345 for other materials.

Prices for materials will vary locally, of course. The amount of concrete you need also depends on where you live. In warm southern Florida, footings aren't needed; you just pour the slab on the ground. So you wouldn't need as much concrete as went into this garage built in Bellmore, N. Y. But in northern Minnesota, you'd need footings 4′ deep, calling for more concrete.

The price can be cut a bit lower if you use plain concrete or cinder block instead of shadow block. Picone Brothers, of Brooklyn, N. Y., makers of concrete block who built this garage for POPULAR SCIENCE, used sha-



COMPLETED BATTER BOARD LAYOUT

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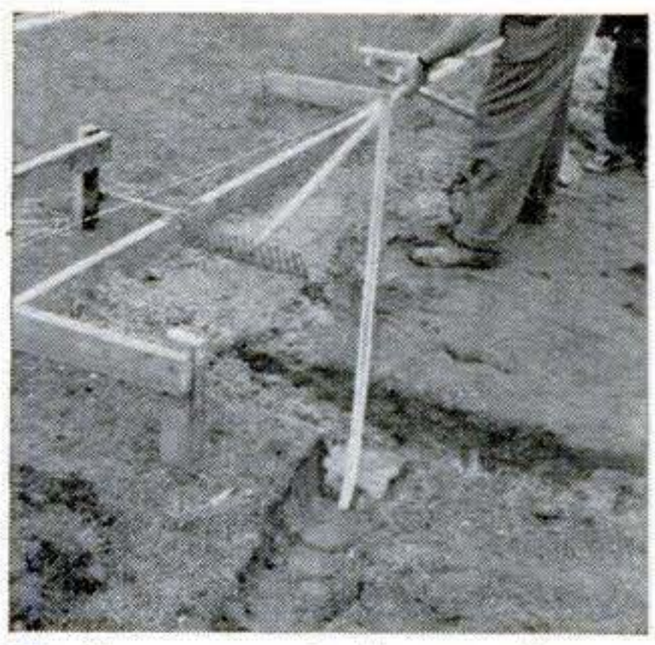
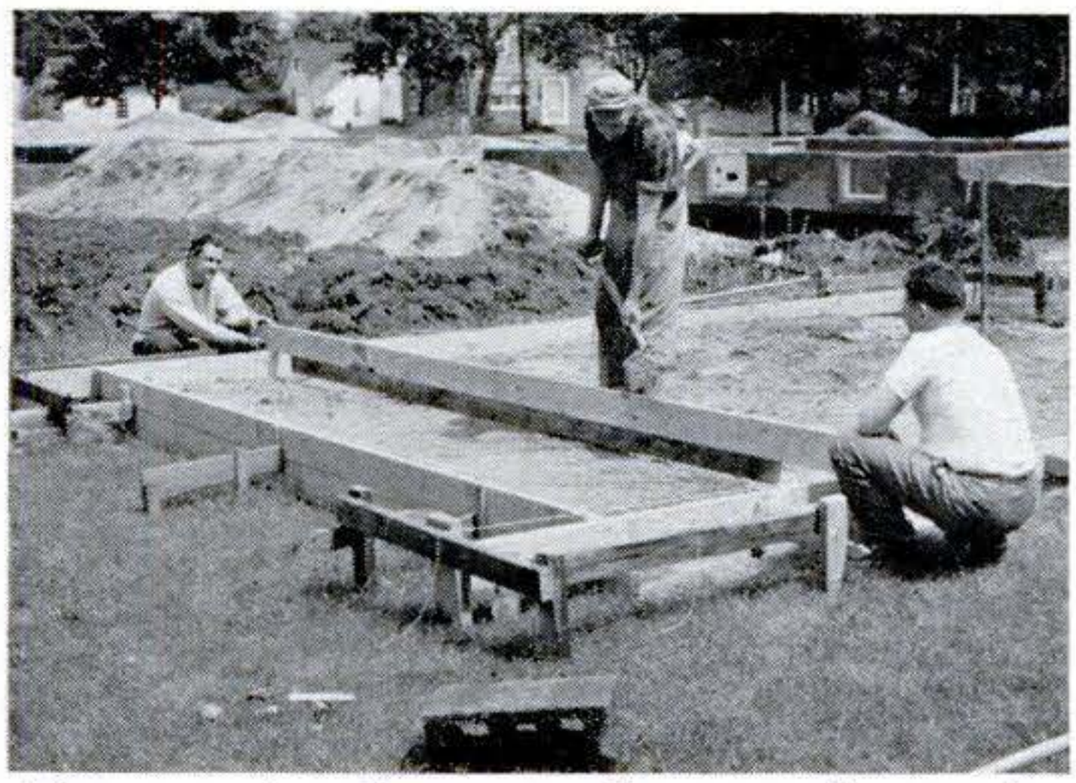
Dig footings to depth required by your local building code. Footings always should be dug below frost line. Otherwise, frost action will heave and crack them, causing walls to settle and crack and doors and windows to stick. If trench walls are compact, no footing forms will be needed.

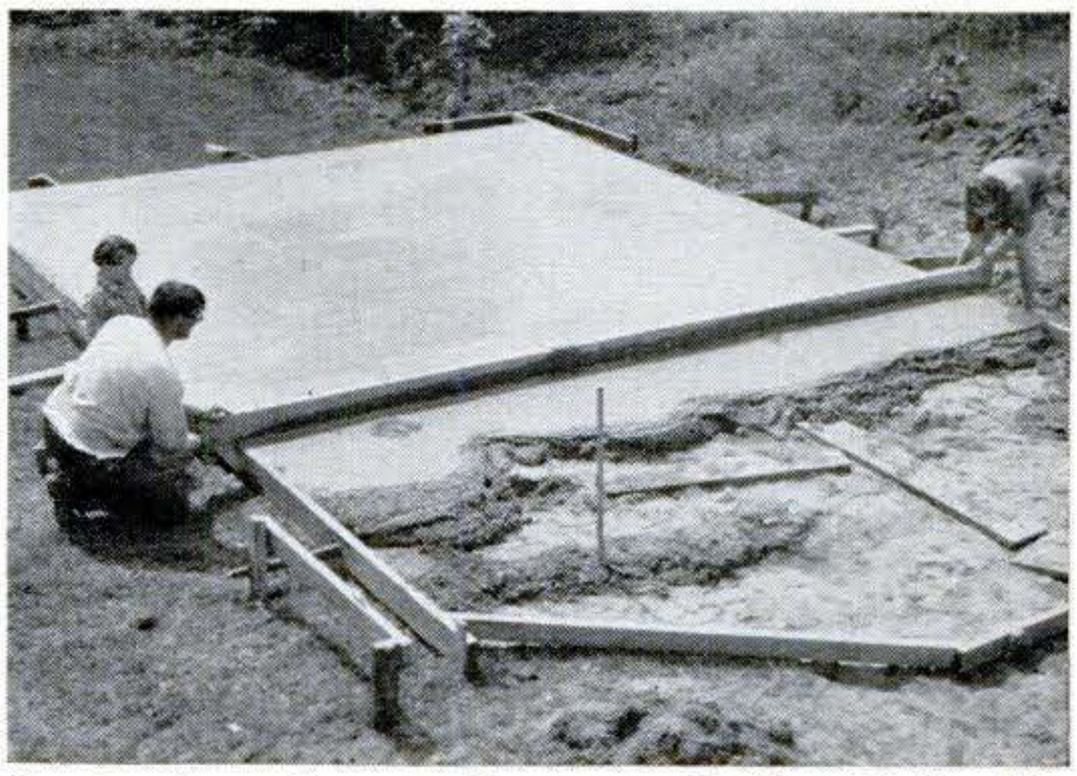
Forms for slab floor are built after trenches for footings have been dug. Outside of slab will be 4″ inside footings. Two-by-sixes, well-braced as shown above, make good forms for slab. Top of slab will be flush with top of forms. For drainage, slab should slope slightly—about ½″—from back to front. Slope is being checked with level in photo above.



Underground electrical connections are best. Dig trench that meets footing trench. Lay 10′ of ¾″ galvanized pipe in trench, locating vertical arm of pipe just inside garage wall. Pipe was curved by bending it around a nearby tree. Later, cable will be pushed through pipe and under ground to basement.



After pouring footings, place gravel or cinder fill and tamp it down solidly. Put fill only where slab will be, not over footings. To level fill before tamping, nail edge of two-by-four to edge of two-by-six. Longer two-by-six rides on form, and two-by-four levels fill.



Strike board is used to screed (level) freshly placed concrete (above). Use two-by-six that reaches across form. Push and pull board back and forth between you and your helper as you also pull it from one end of form to other end. Screed concrete as it is poured.

Good-luck penny is buried in center of fresh slab during break in pouring operation. Concrete worker's custom of placing coin in center of slab is similar to carpenters nailing branch of tree to roof ridge of newly built house—it's said to bring good luck.

After all of slab and apron has been poured and screeded, go over surface with wooden float followed by trowel. Work both float and trowel over surface with sweeping, circular motion. Floating and troweling concrete give it a smooth surface. Work from first part of pour to last.

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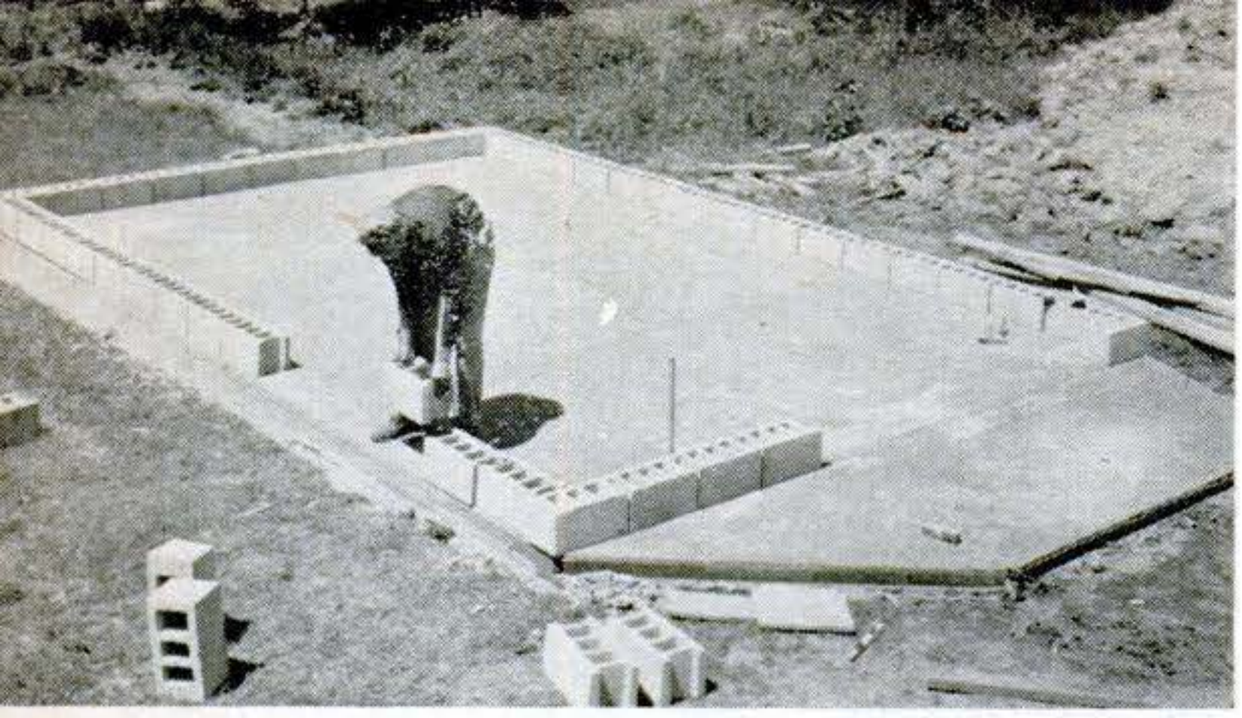
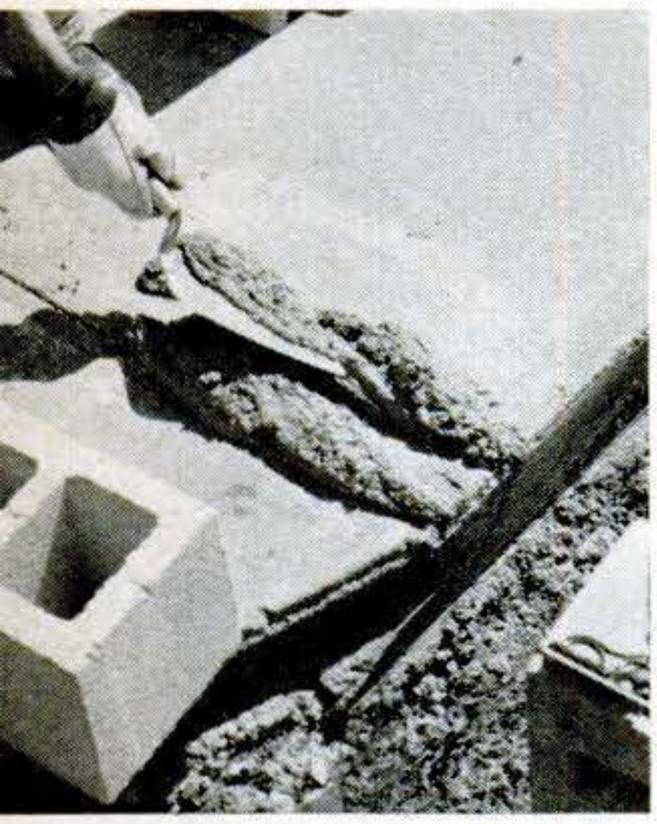


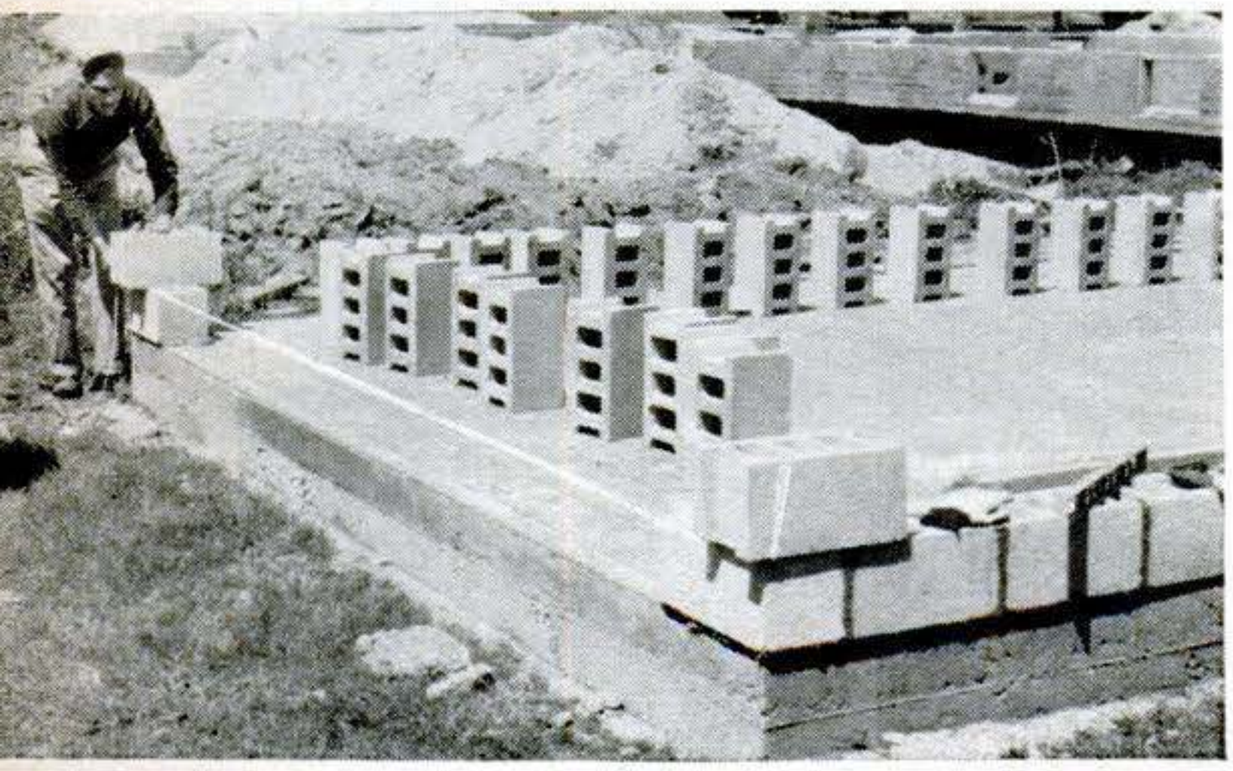


Job begins to look like start of a building now. When slab has hardened (having been kept wet for three or four days), place all blocks of first course in their positions. This correctly spaces blocks before setting them in mortar.

Laying first block. Begin at corner and put down full bed of mortar (left). All blocks in first course are laid in full mortar bed.

With first block set in mortar, level it in both directions. Put level on block (left) and tap ends of block until it's level. Turn level crosswise on block and tap on edges, if necessary, to level block in that direction.

Lay first-course blocks at each corner. Then put one block—not set in mortar—on top of each corner block. Run chalk line (below) between these blocks. Pull line straight and tight. Blocks between corner blocks will be laid with their tops just level with the chalk line.



dow block to match the siding of the nearby house. One side of a shadow block slopes outward so it is ½″ wider at the base than at the top. After a building of these blocks is painted, the vertical and horizontal joints are invisible and the walls look like clapboard. All three types of block—plain concrete, cinder, and shadow—are laid in the same way.

How many blocks? Half the fun of building anything for yourself is sitting down with a pencil and paper and making plans and figuring costs.

Estimating the number of blocks you'll need is easy. Take the number of blocks needed for one course around the building. Multiply that number by the number of courses. The result is the total number of blocks in the walls without deducting for openings. Count the number of blocks replaced by door and window openings and subtract that number.

Don't forget that you'll need corner blocks. Multiply the number of courses by the number of corners to get the number of corner blocks you'll need. Then subtract the corner blocks from the plain units.

You'll need half blocks at all window and door openings. Instead of cutting blocks to make half blocks, it's better to buy half units. The number of these you'll need can be counted quickly. Every other course on each side of an opening takes a half block.

To play safe, order a few extra ones of each kind so possible breakage won't hold you up.

Laying out your garage. In planning your building, lay it out to fit the dimensions of the blocks. Standard blocks are 7⅝″ by 7⅝″ by 15⅝″. With ⅜″ mortar joints, a block occupies 8″ by 8″ by 16″ of space. When you've decided on the dimensions for your garage, figure how many 8″ by 8″ by 16″ blocks wide and long the building will be. If it's a few inches more or less, plan to use those dimensions rather than cut down the blocks. That's why this garage—planned for 14′ by 21′—was built 14′ 8″ by 21′ 4″.

If you're going to build near a property line, locate the line first. Then check your local building code to see how far from the line your garage must be.

With that line established, you can set up the batter boards and run the chalk lines as shown in the drawing and photos. The distance between the batter boards and chalk lines is not important. But be sure to set the boards back far enough to give yourself

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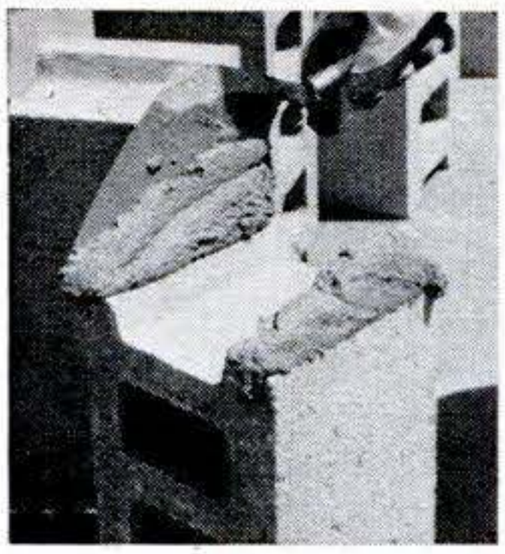
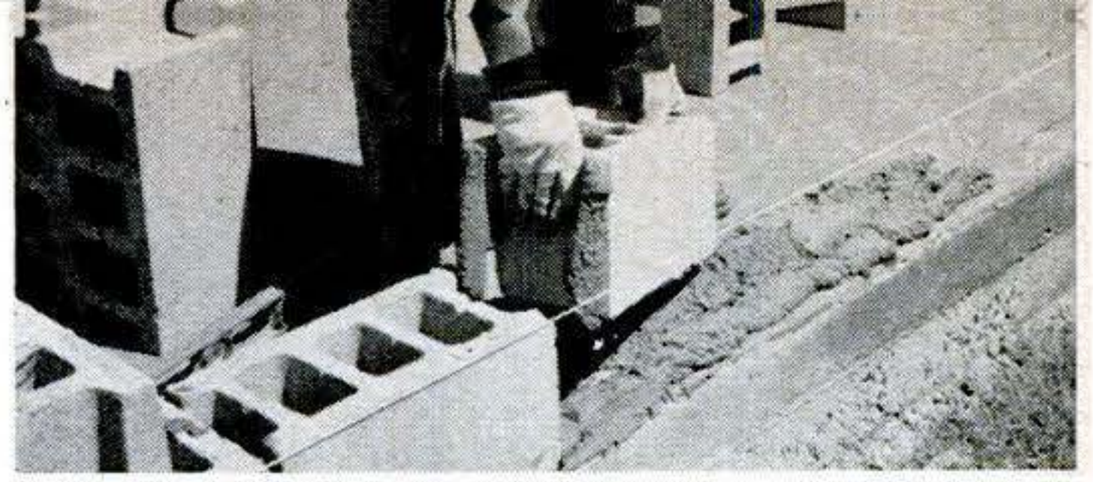
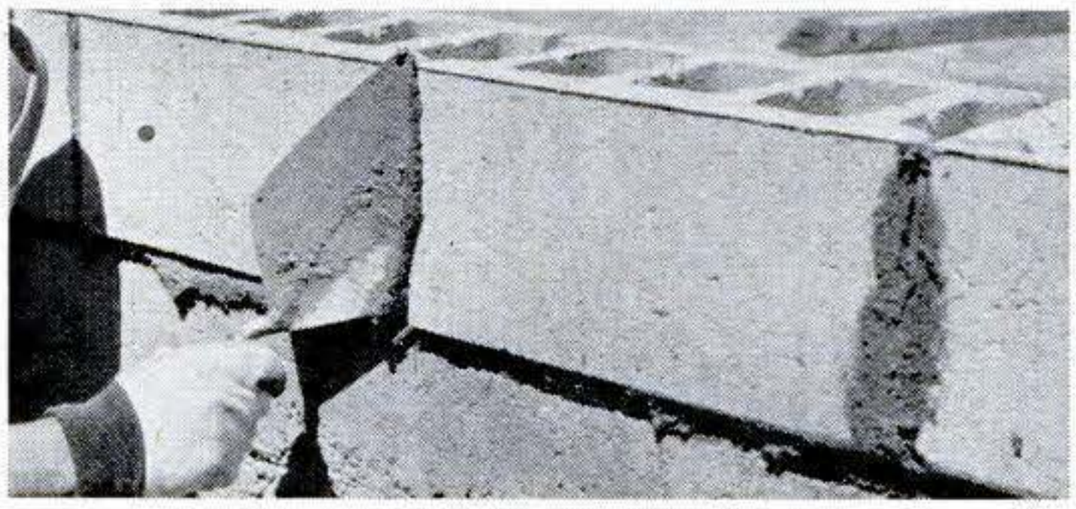


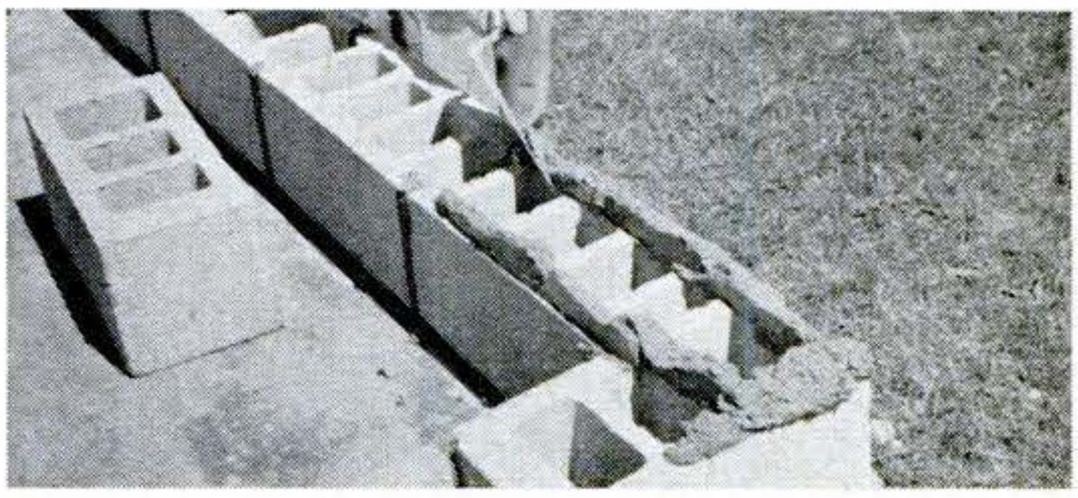
Lay down thick bed of mortar for first course. Butter one end of a block with mortar (left). Take a full trowel of mortar and tap half of it off on one flange and the rest on the other flange. Put mortar on flanges at only one end of the block.



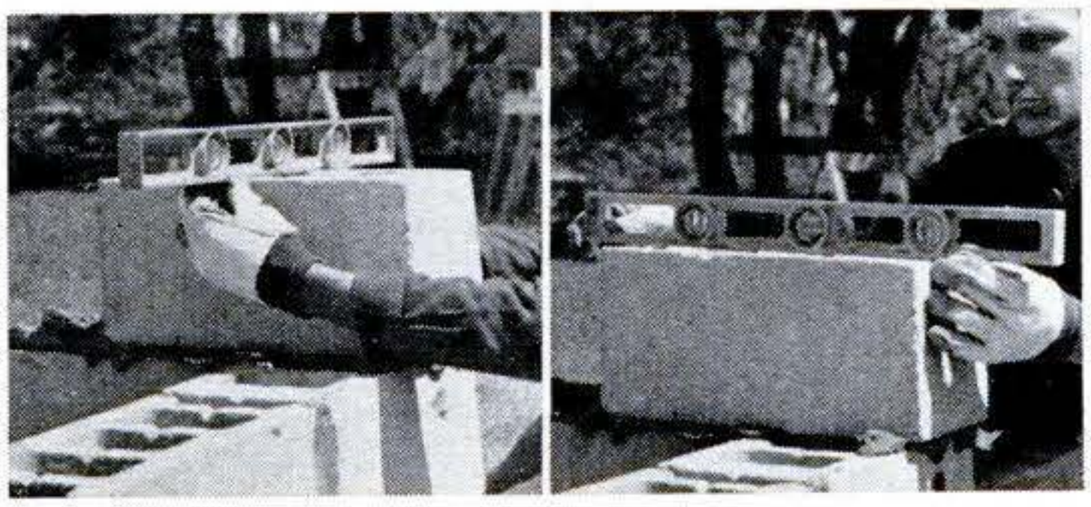
Grasp block by ends (above) and set it in place, pushing it down until the top edge is even with the chalk line. Push mortared end against previously set block until only a ⅜" mortar joint remains between the two blocks.



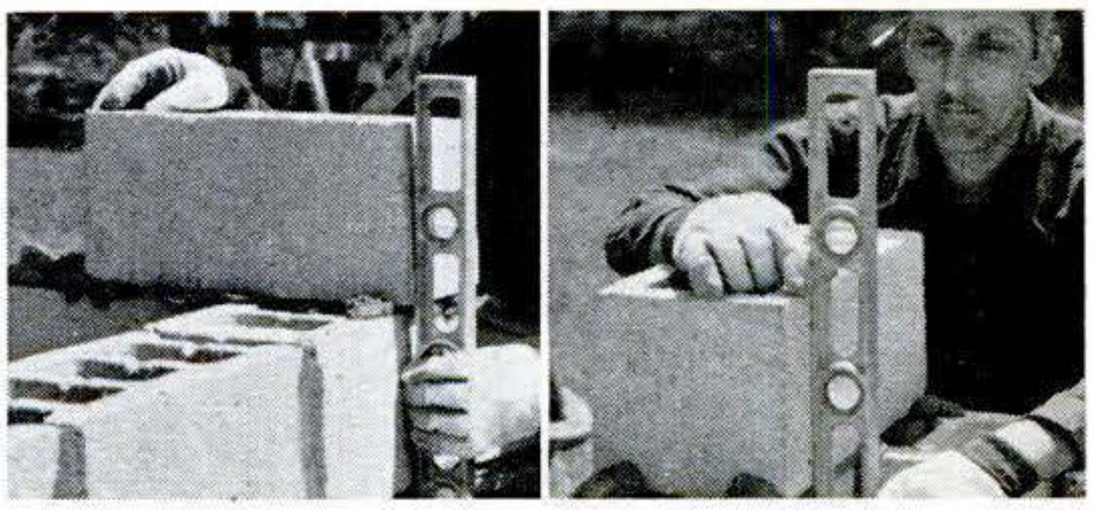
Mortar will ooze out between blocks. Smooth this excess mortar with your trowel; don't just scrape it off. Pack it into the joints. Use edge of your trowel to smooth excess mortar that oozes out along bottom of blocks.



Face-shell bedding (above) is used on all courses after first one. Put mortar in two rows on outside edges of blocks. Photo above shows first step in building up a corner. All corners are built up and then blocks laid between.



Corners are important and must be level since chalk lines between them control straightness and levelness of blocks in between corners.



Make sure corner blocks are level in both directions and flush outside and inside the wall, as shown left to right in photos above.

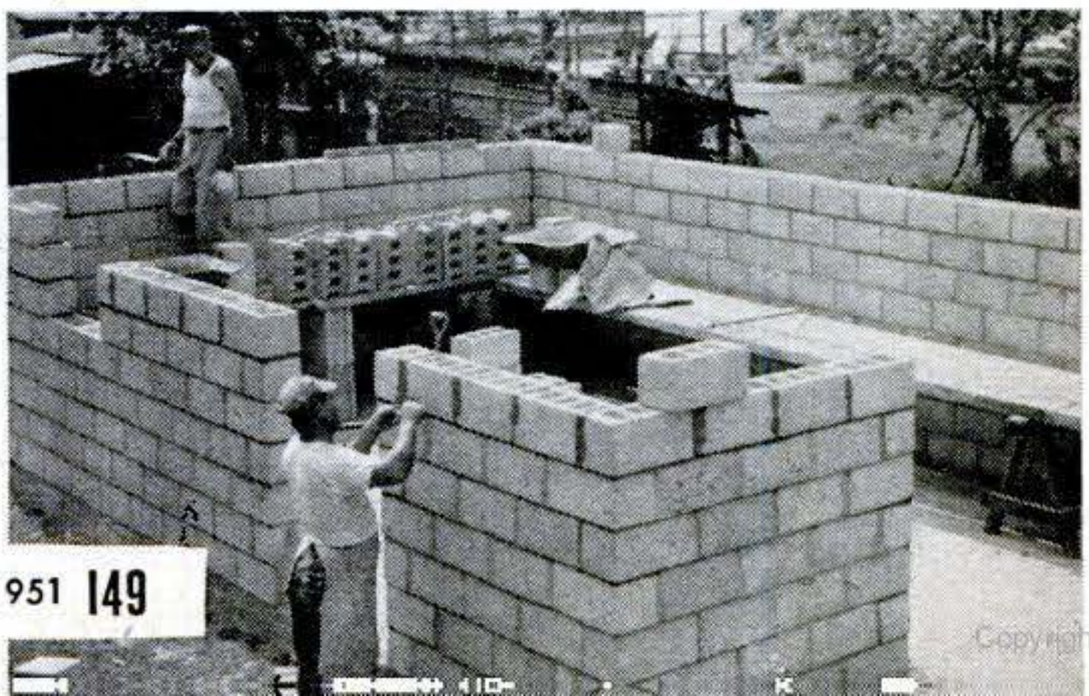
ample space in which to work—about 4′.

Digging for footings. For small buildings—garages and one-story homes—footings usually are made twice the width of the wall and one half the width of the footing in depth. For instance, an 8″ wall would take a footing 16″ wide and 8″ deep. However, footings should be dug below the frost line. It's best to follow the requirements of the building code in your community. If the soil is compact, you won't need forms for the footings.

Mixing concrete. On a job of this size, your best bet is to rent a small concrete mixer for the foundation and slab. It will save you time and labor. The recommended mixture for footings and slabs is 1 sack of Portland cement, 2¾ cu. ft. of sand, and 4 cu. ft. of gravel. To this, add 5½ gal. of water. Don't use more than the recom-

Build up each corner three or four courses high before laying blocks in between. Use a mason's level to lay blocks plumb and straight.

When you have laid courses between built-up corners, build up corners again and continue laying blocks, using chalk line on each course.



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Split lintels (cast in two pieces) are easier to handle than those cast in one piece. String line and spread mortar as you would for a block. Place outside half of lintel first (above). Set other half behind the first half and fill the joint between them with mortar.

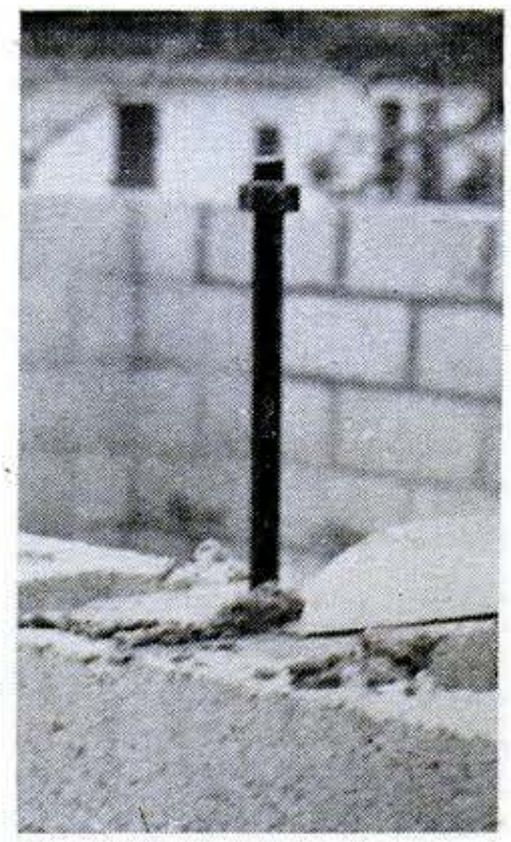
mended amount of water; too much water weakens concrete. If the sand is wet, use less water in your mixture.

An easy way to measure the cubic feet of sand and gravel is to build a box with inside dimensions of 1′ by 1′ by 1′. Filled with sand or gravel, the box will give you 1 cu. ft. For convenience, you can mark a line around the inside of the box 9″ from the bottom. Filled to that line, you'll have ¾ cu. ft. for the sand measurement.

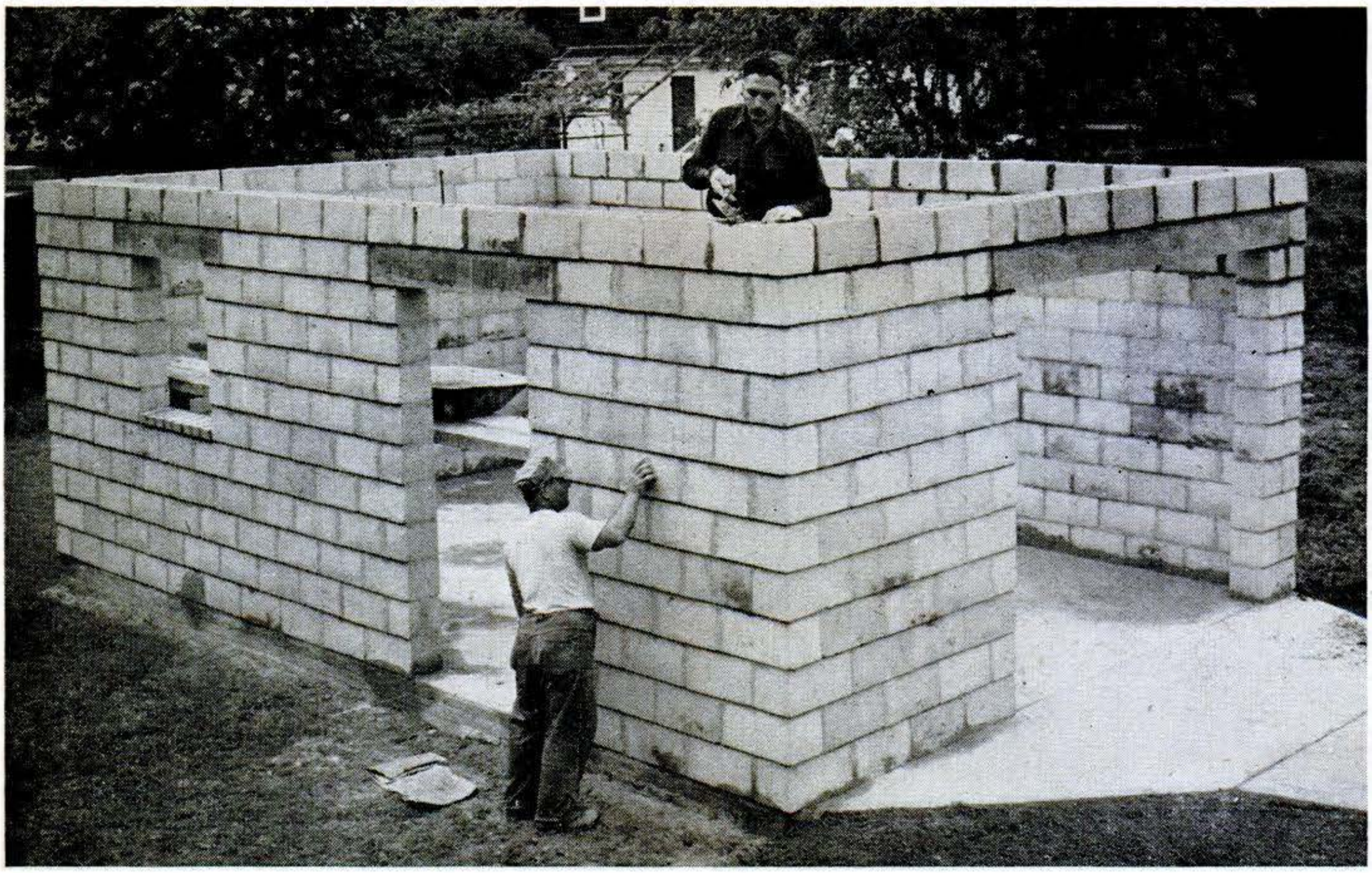
Mixing mortar. When you're ready to lay blocks, mix one volume of prepared mortar cement with between two and three volumes of sand, or as directed on the bag.

Bricks for window sill are laid in a bed of mortar. Put mortar on one side of each brick as you lay the bricks. Set bricks so outside ends are flush with outside of wall.

Anchor bolts are set 4′ apart in last course (right). Two-by-six plates to which rafters will be nailed are held to blocks by anchor bolts. Use ⅜″ or ½″ bolts 12″ long. Push tightly wadded newspaper in core of next to last course to stop mortar from dropping down through wall. Put bolt in core over paper and fill core with mortar.



All masonry work has been completed (below) and anchor bolts are being set. Man on ground is smoothing mortar joints by rubbing them with a brick. Joints must be flush before painting. If some joints are not completely filled, add mortar to bring them flush with wall surface.



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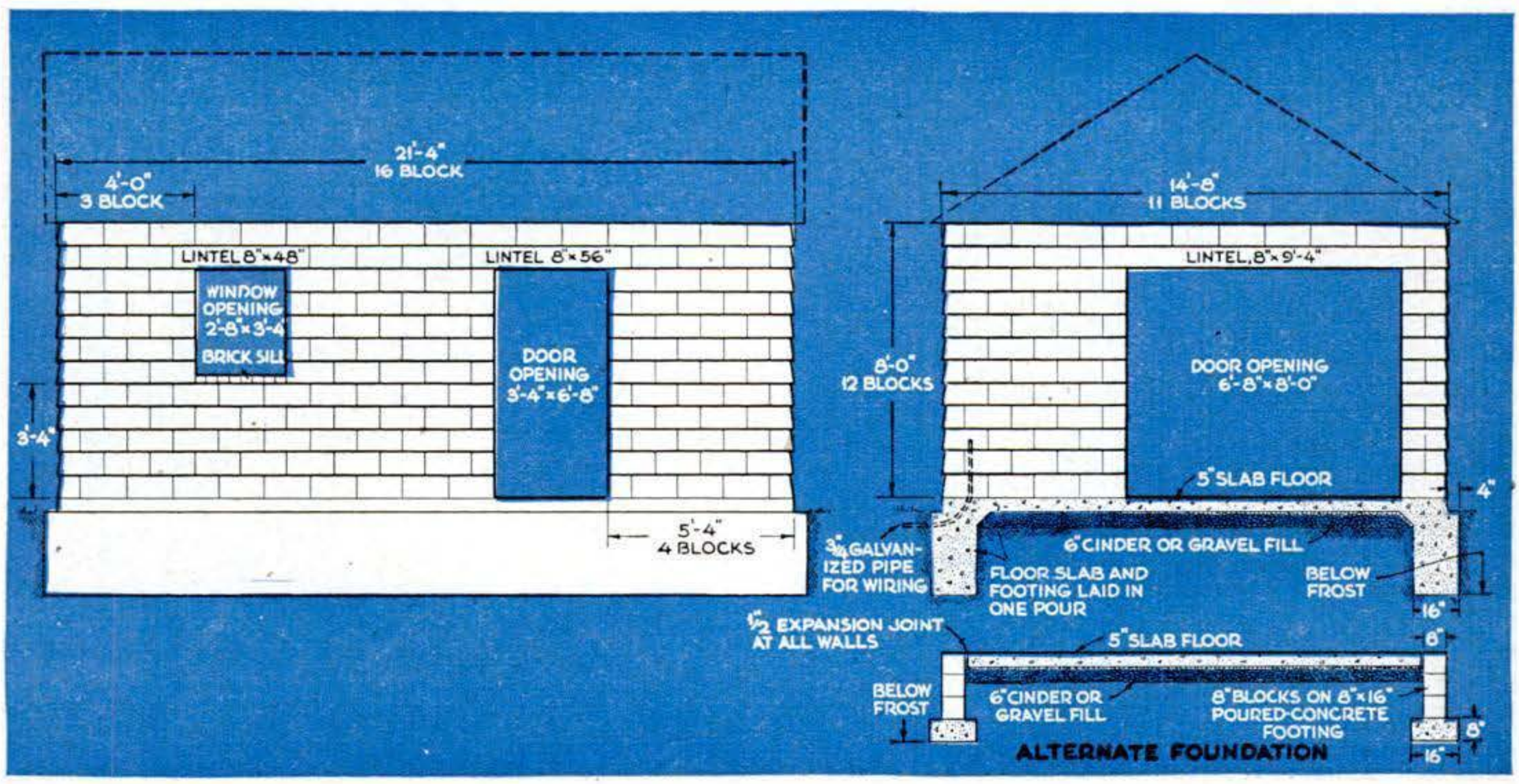
Add enough water to make a stiff, workable mixture. Don't use a concrete mixer for making mortar, because the machine will turn it out faster than you can use it. A metal wheelbarrow makes a good mixing tray. Use a hoe to mix the mortar cement and sand.

Before you set any blocks in mortar, it's a good idea to lay out all the blocks for the first course, as shown in a photo. That will help you locate openings and space the blocks for the ⅜" mortar joints. END

Putting on the roof, installing doors and windows, and painting the garage will be described in next month's issue.

LIST OF MATERIALS

24 cubic yards of sand and gravel.
50 bags of Portland cement.
15 bags of mortar cement.
516 concrete blocks for garage walls.
8 bricks for the window sill.
4' precast lintel for the window.
4' 8" lintel for the side door.
9' 4" lintel for the main door.
343' of two-by-six.
52' of two-by-four.
120' of 10" beveled siding for gable ends.
525 square feet of sheathing for the roof.
500 square feet of roofing paper.
500 square feet of composition shingles.
Doors, window, hardware, paint.



MIXING CONCRETE

Thorough mixing of the cement, sand, and aggregate is necessary for concrete. If the job is large, it is best to borrow or hire a mixing machine, but the mixing can be done, if necessary, on a platform about 8' by 14'. Make the platform of 1½" to 2" stock, preferably tongued and grooved, and nail strips on three sides so no cement will be washed away and lost. The platform should be near the site so the concrete can be shoveled directly into the forms.

An average wheelbarrow will hold about 2 cu. ft. of sand or crushed stone and can be used for measuring. Or the materials may be shoveled into a bottomless box placed on the platform and then lifted away. One 12" high by 24" by 24" inside will hold 4 cu. ft. Lines marked inside at 3", 6", and 9" heights will measure 1, 2, and 3 cu. ft. One bag of cement measures 1 cu. ft.

Put the sand on the platform first and spread the cement on it evenly. Mix thoroughly with a shovel, first dry and then wet. Spread out the mortar, put the crushed stone or other aggregate on top, and mix thoroughly, adding more water as required. Light aggregate may also be mixed dry with the cement and sand before water is added.

A minimum of water produces the greatest strength in the finished concrete, but be careful not to use too little, as that would prevent proper mixing. Generally, when the sand and aggregate are dry, a minimum of about 5½ gal. to each bag of cement will be found about right. Less water will be needed, of course, when the materials are wet. The water used must be free of all impurities. To be suitable, it should be fit to drink.

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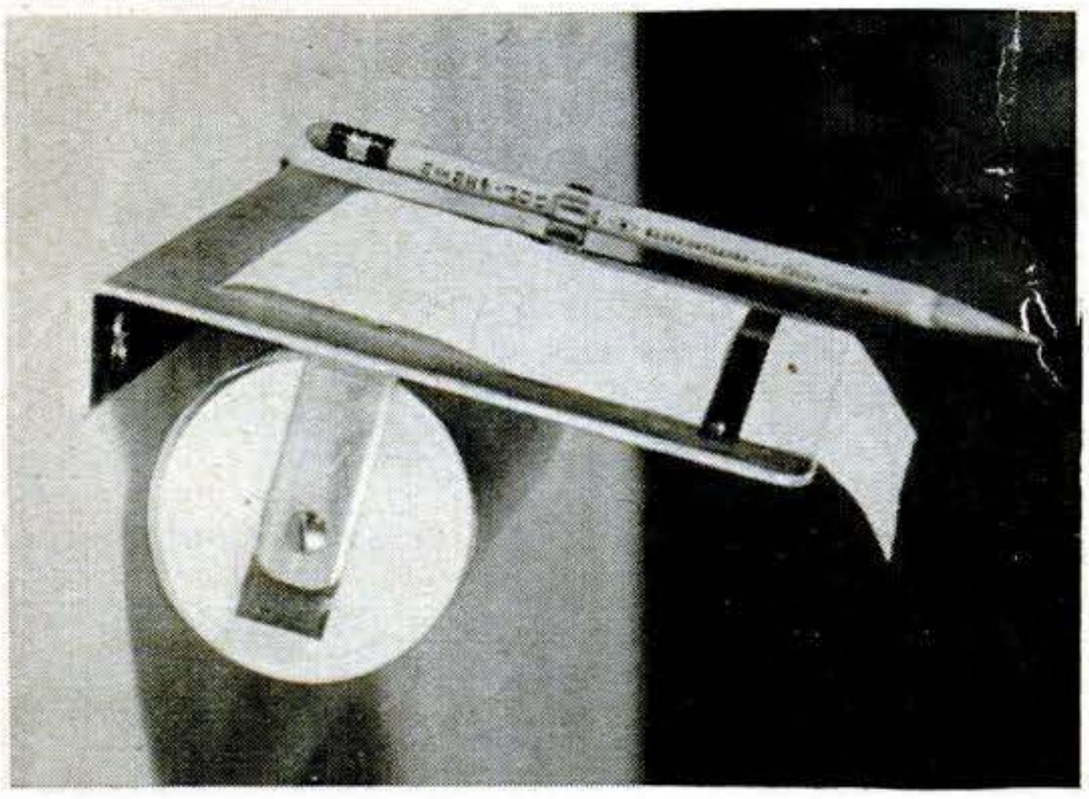
Wall-Mounted Memo Pad Is Endless



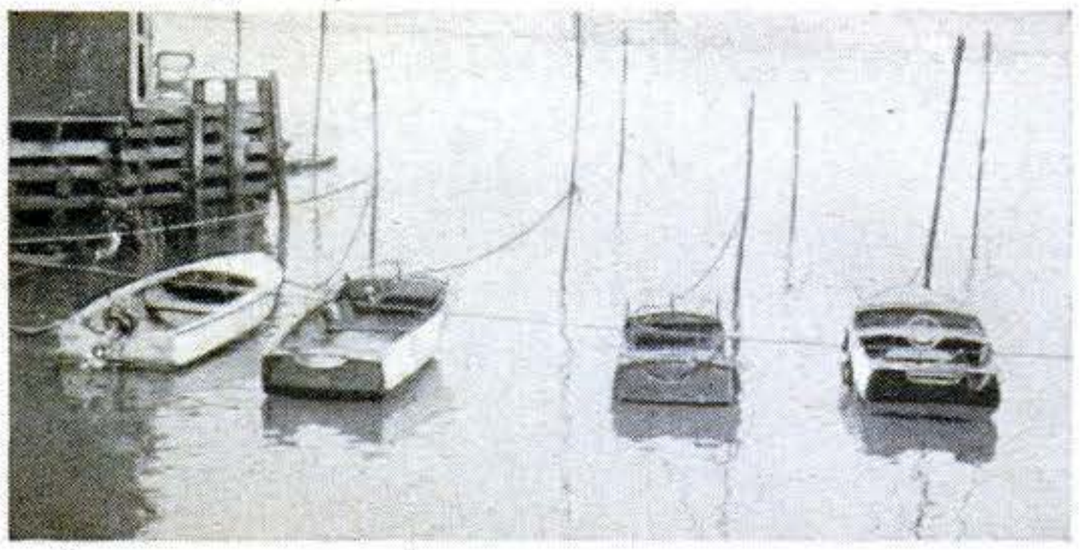
A ROLL of adding-machine paper, threaded through a holder screwed to a wall or cabinet, makes a handy pad for jotting notes.

Make the holder of .125″ aluminum. Saw out the blind slot for the paper. Rivet or screw a piece of clock spring at one end to hold the paper tight and make it easy to tear off notes. Drill and file keyhole screw slots at the other end, and then form the bend. Rivet a U-shaped bracket to the holder.—*Walter M. Hine, Lynbrook, N. Y.*

Chemical Balks Mildew on Sails

CANVAS treated with a new solution is said to remain mildewproof for at least a year under extreme tropical conditions, and for two or three years under normal conditions. Sails are treated by dipping them in a mixture of nine parts water to one part of Barfair 77. The solution can be swabbed or sprayed on large sails. It is made by Barfair Laboratories, Haddonfield, N.J.

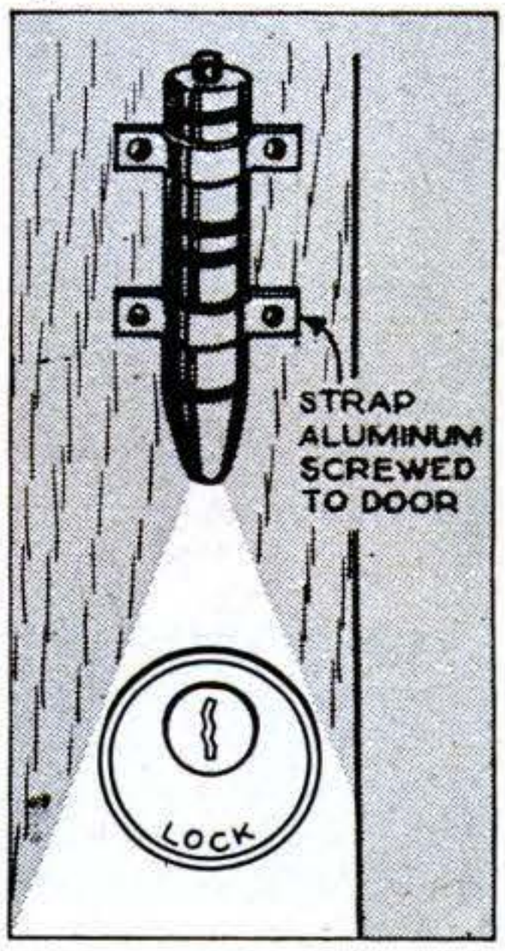
Mooring Boats in a Small Area



THESE four outboard hulls are snugly berthed in a space that might otherwise be taken up by one boat if it were swinging free. Each boat has a bow line tied to its own stake. Stern lines connect to a common line running behind the boats.—*Elon Jessup, Woods Hole, Mass.*

Pocket Flash Lights Up Lock

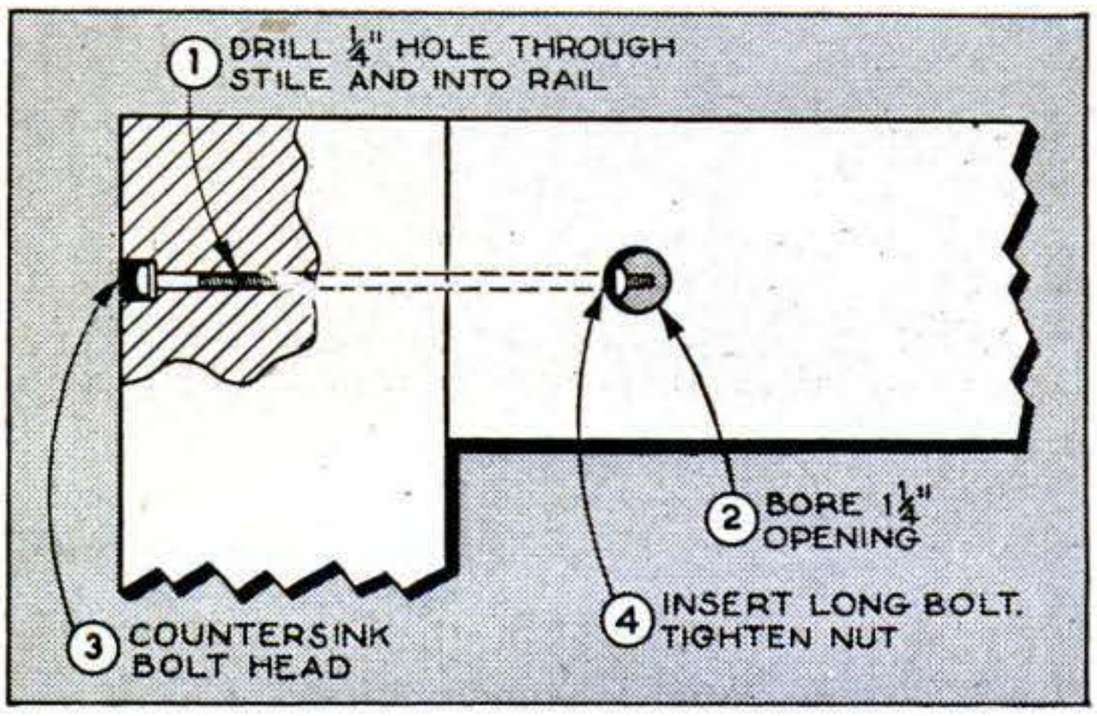
IF you have trouble finding the keyhole in your garage or house lock in the dark, you can illuminate it by fastening a pocket flashlight near the lock as shown.



On padlocked garages, fasten the flashlight about a foot away from the lock to get a wider distribution of light.—*George Kapitan, The Bronx, N. Y.*

Bolt Reinforces Sagging Door Joint

IF a corner joint on your garage door has started to spread, you may be able to pull it together by drilling holes through the stile and rail as shown, inserting a long bolt, and drawing up tightly on the nut. Fill and paint the large hole in the rail to keep water out.—*T. H. Kerr, Columbus, Ohio.*



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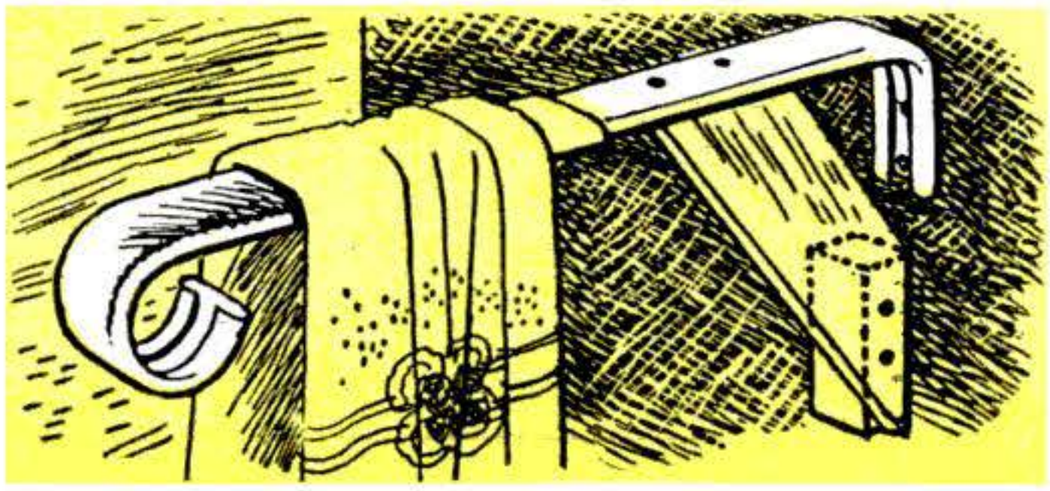
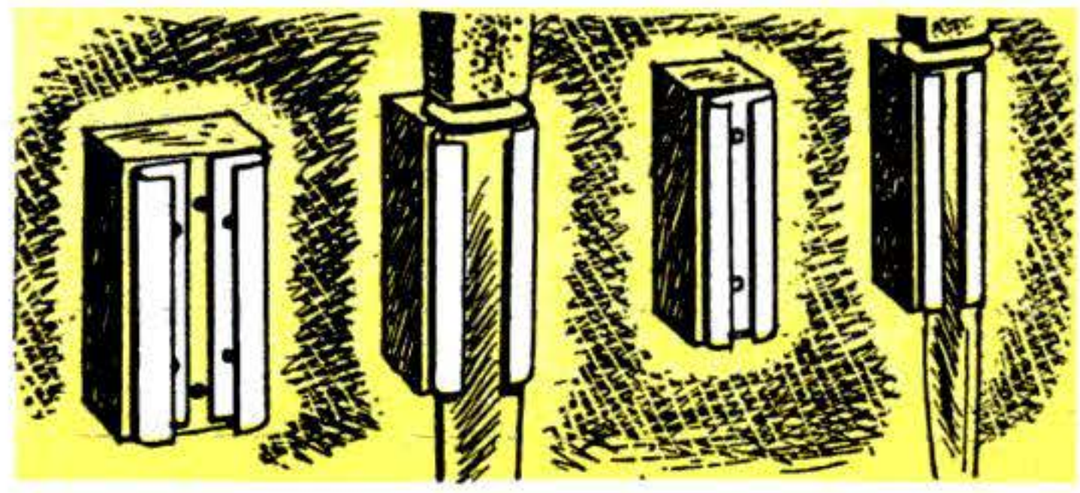
Use Curtain Rods

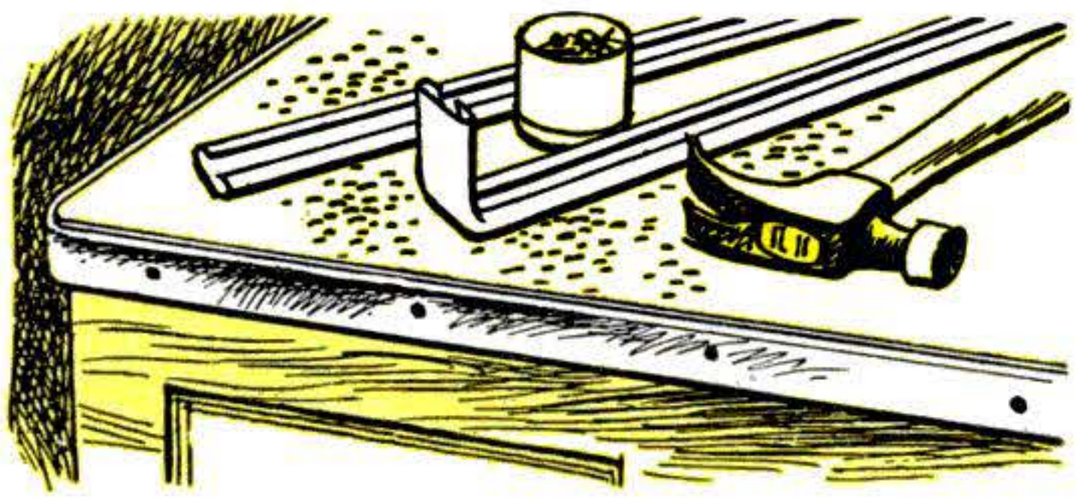
They'll do a lot more than just hold up curtains. Here are eight suggestions.



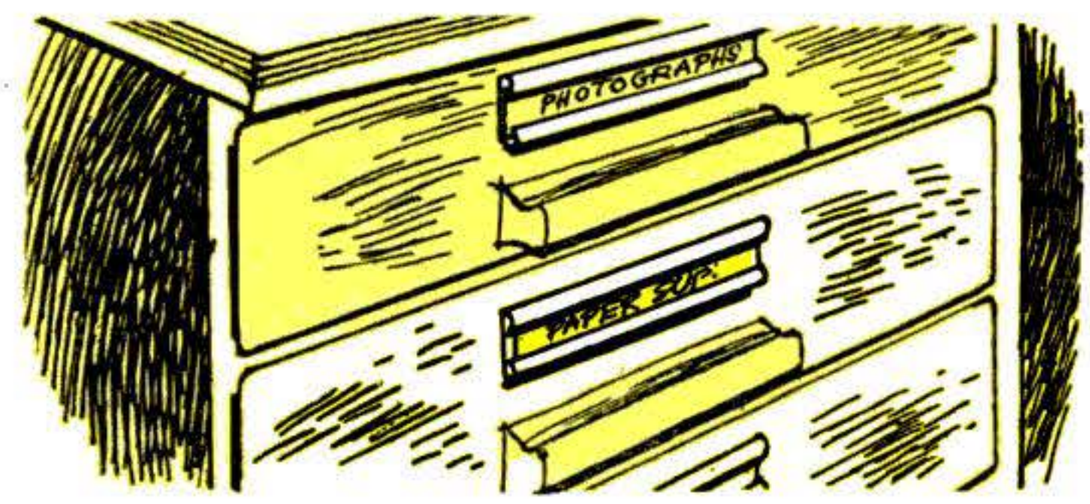
Need a sliding towel rack? Mount the inner part of a rod, cut to length, at right angles on a wall or cabinet back. Brace with a plywood bracket fitting into the slot. Bend the end of the sliding section around as a handle.



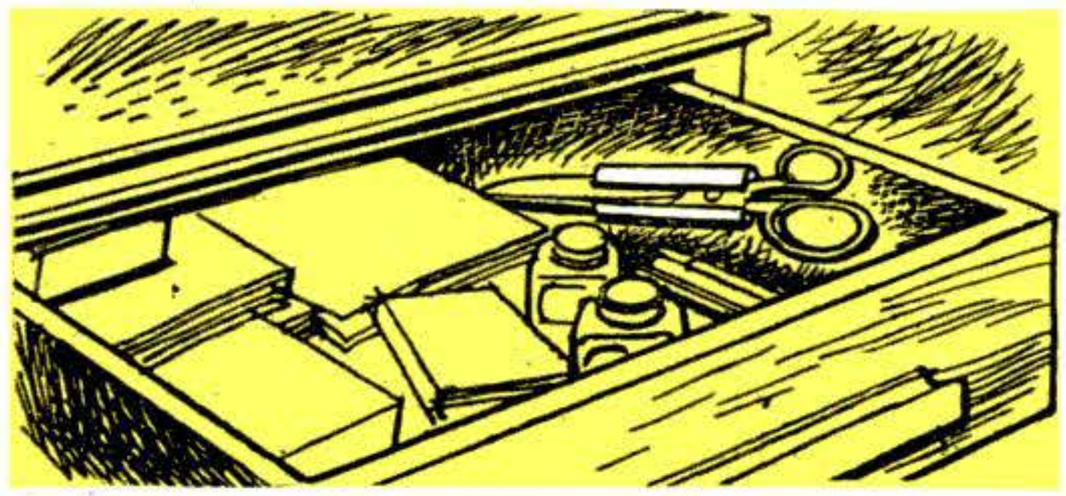
Knife racks can be made of short rod sections set off a wall on blocks. Spread the flanges, or cut them apart and mount separately, so knives are not gripped by edges but rest on handles. Grooves can be lined with oiled felt.



Metal stripping for edging benches, toys, or linoleum can be made by snipping off the two ends at the bends with tin shears and pounding the straight piece flat with a hammer. The metal is soft enough to take tacks and brads.

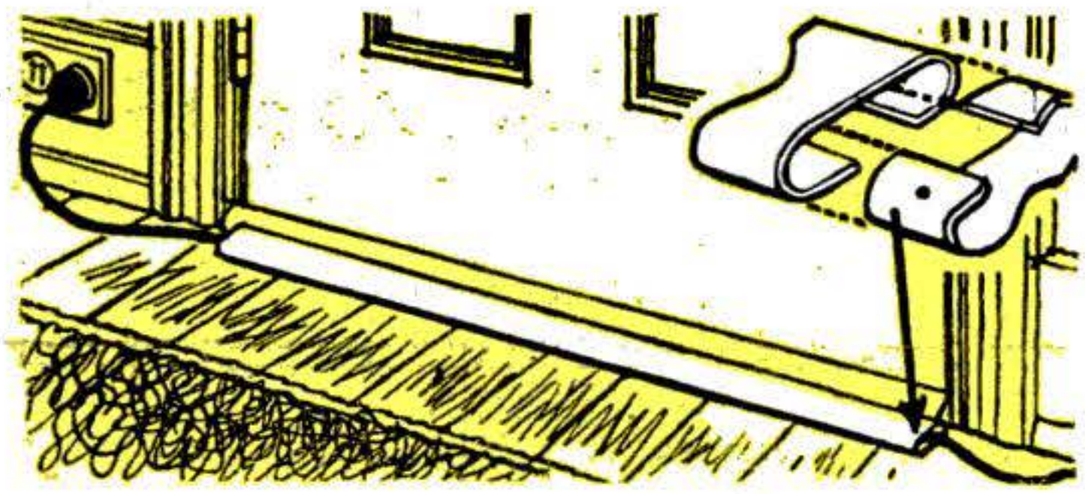


Label holders for shop drawers are a cinch to make. Drill or punch holes through the back of each holder to take screws or brads for fastening. Tap the curved edges down tightly after inserting the labels.

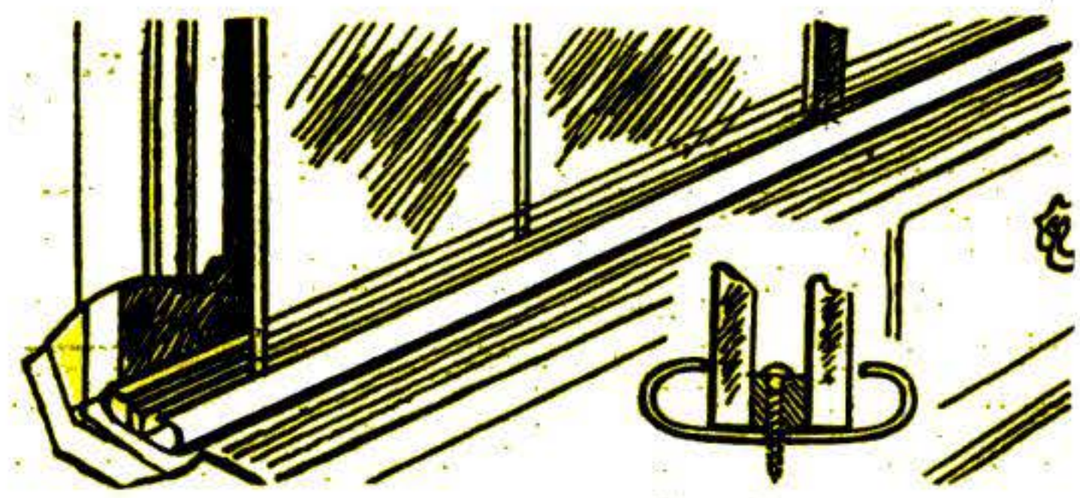


For a safe holder for scissors, use a bit of rod tacked at an angle in a drawer. For large shears, bend out the curved sides of the rod to take the thickness of the blades, or split the rods and separate, as for the knife rack.

A plate rail for pantry shelves can be improvised from a curtain rod with the bent ends cut off. This same trick makes a guide rail to hold a large tray on end in a kitchen or dining-room cupboard.



When appliance cords must be temporarily strung across doorways, encase them in tubes formed by sliding one piece of rod into the other in reversed position. Tape cut ends, and also tape wires at these ends for protection.



Sliding glass doors on small cabinets can use lengths of curtain rod as top and bottom guide rails. A wood strip acts as a separator. Small brads or screws through strip and curtain rod fasten them both down.

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What you should know about

Buying an Auto Paint Job

Look sharp in cut-rate shops or you may lose more than you gain. A good job takes time, skill, and equipment.

WHY should you pay $150 to have your car repainted when you can get it done for $40? Stand the two completed jobs side by side, and they both look good.

In fact, *one may actually be as good as the other*—and you'll be in the chips with a $40 job. A low overhead, a low margin of profit, and a volume business can make it possible for one shop to charge bargain-basement prices and turn out a job that will stand up well for years.

But cutting prices may also mean cutting corners. If you ever have painted a car, you know the job takes time, patience, and a fair degree of skill. There are many chances for cutting corners. Failing to sand off rust, for instance. Or skipping the sealer coat.

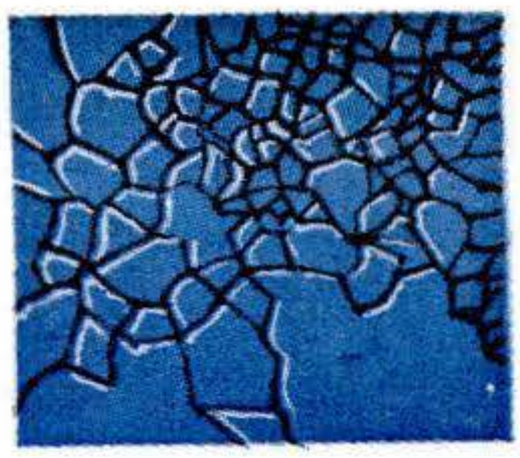
Here are defects that might show up in a corner-cutting paint job:

Peeling is what happens most often. Sometimes the entire paint film lifts off, right down to the bare metal, and you can see rust that wasn't removed. Or the sealer (if used) hasn't stuck to the primer coat, or finish coat to sealer.

Wrinkling crops up frequently, too. This is a condition you can practically always blame on the man who did the job.

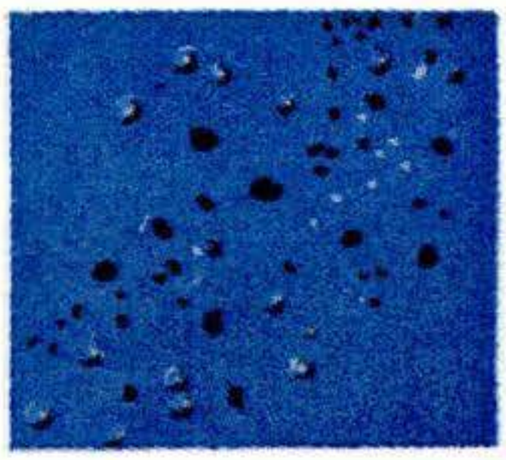
Perhaps too heavy a coat was applied. Or the painter may have used a thinner that dries too fast. In warm weather this will produce a very heavy coat that will surface-dry too rapidly. Insufficient thinner is another cause of wrinkling.

Cracking and checking may come from too much haste in turning out the job—applying finish coats before the coats underneath are thoroughly dry. Sudden temperature changes or the movement of body panels may also cause fine cracks.



Should you take back a defective job like this, the painter might tell you "spotting in" would fix it up. It won't. The entire panel must be completely refinished.

Blistering of car paint can be caused by a variety of conditions, but if it happens soon after the car comes from the shop, you can usually blame the painter.



Poor preparation of the metal nearly always causes blisters and bubbles. Perhaps rust inhibitor wasn't used. Grease, oil, or dirt may have been left on the surface before painting. Moisture or oil in the air line of the spray gun can cause blisters, too.

But if the job is done at a time of high temperature and humidity, be cautious about blaming the shop. These conditions may blister the *best* paint job. So also can

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near-by chemical plants and locomotives.

How can you avoid such defects? Even in a high-priced job, some of them may show up. But your chances of missing them are far better.

Above all, know the shop and its reputation. If you are doubtful, stand around awhile and watch the work.

It will also help to know what you could expect to see in a top-notch shop. Suppose you wander in just as one of the boys starts work on a fender. You see the fender has been neatly bumped out and filled. All of the old paint has been sanded off. A chemical rust inhibitor is applied to the metal.

You find the paint booth dustproof and well ventilated. In there, a primer coat is quickly sprayed over the bare metal. This primer, you are told, fills in depressions in the metal and gives a smooth surface for the coats to follow.

Next you watch the sealer coat being applied. The painter tells you this coat is mighty important. It seals the primer away from the color coats and keeps the primer from bleeding into the color.

After the sealer coat has dried, the color coats are added—several of them, with proper drying intervals between. In a big shop, the paint may be baked on.

If you see skimping or skipping anywhere along the line, better be wary of that $40 price tag. In the long run, the cheap job may actually cost you more. END

Tips on Keeping Body Paint in Good Shape

Spotting. A summer shower can spot paint. If sun comes out, drops of water on car act like tiny magnifying glasses, concentrating heat and burning paint. A cleaner-polish will usually remove such spots. If tree sap spots paint, use wax remover.

Bruising and chipping. Road stones often chip paint from bottom edges of fenders. If not attended to quickly, these spots will soon begin to rust. You can buy small cans of touch-up paint for this. If rust has appeared, sand off before applying paint.

Chalking, a normal chemical reaction, causes paint film to powder. Regular washing and use of a cleaner will remove this chalk and restore the original lustre.

Burning the paint may result if you bear down too much with power buffer while polishing. Such a burned spot is a flaw in car's protective armor. Repaint it at once.

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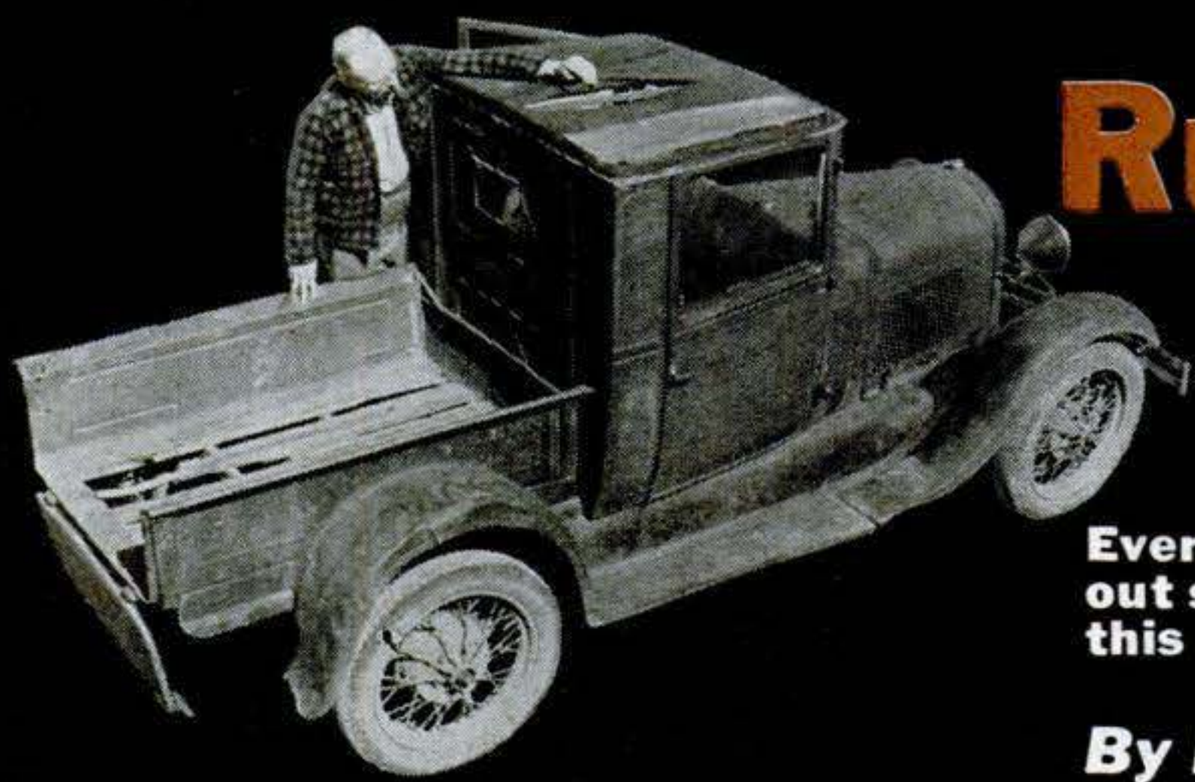
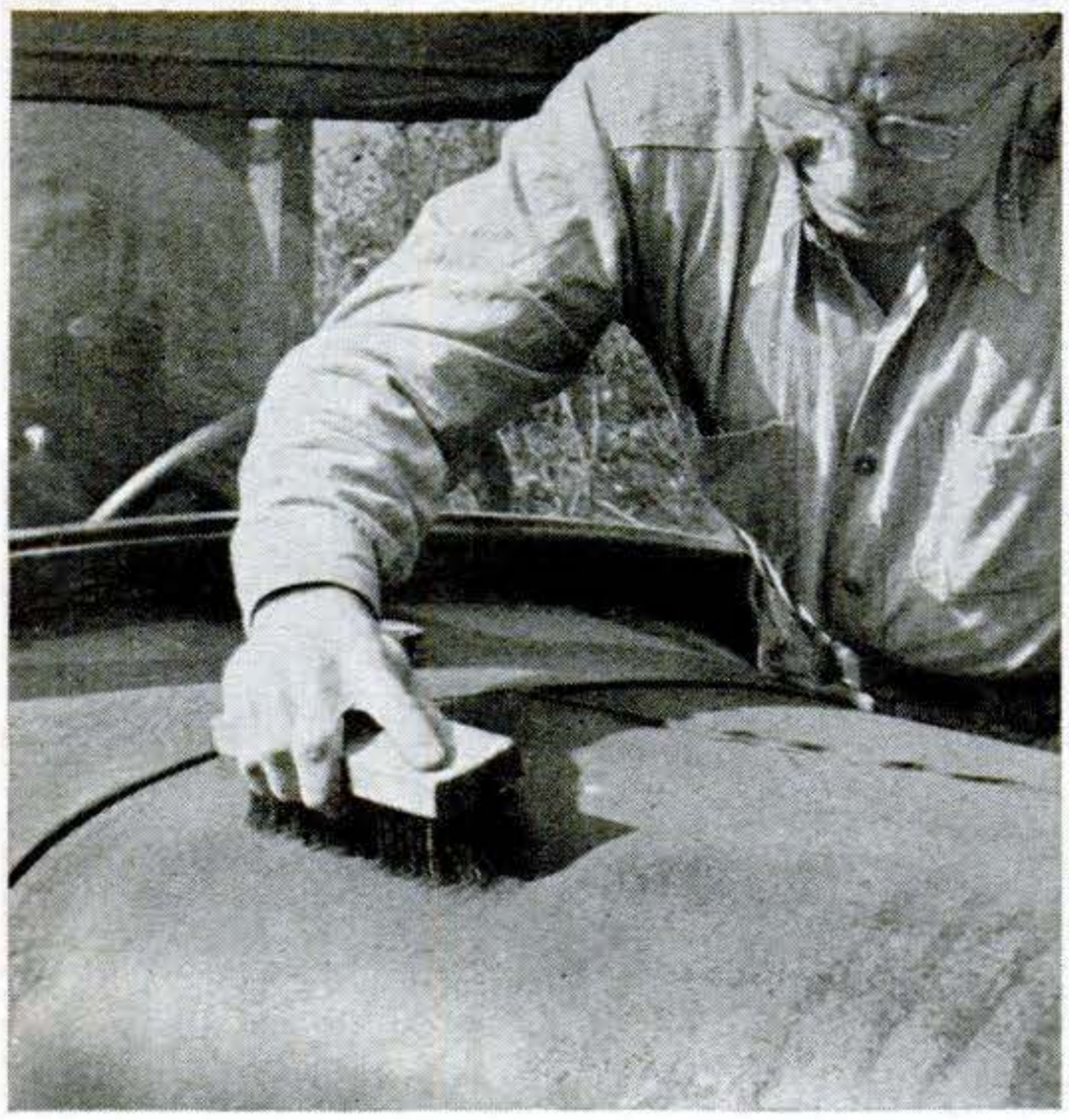


Rusty Gets a New Coat

Ever hear of the paint you can apply without sanding off rust? Look what it did for this old truck.

By Mark West



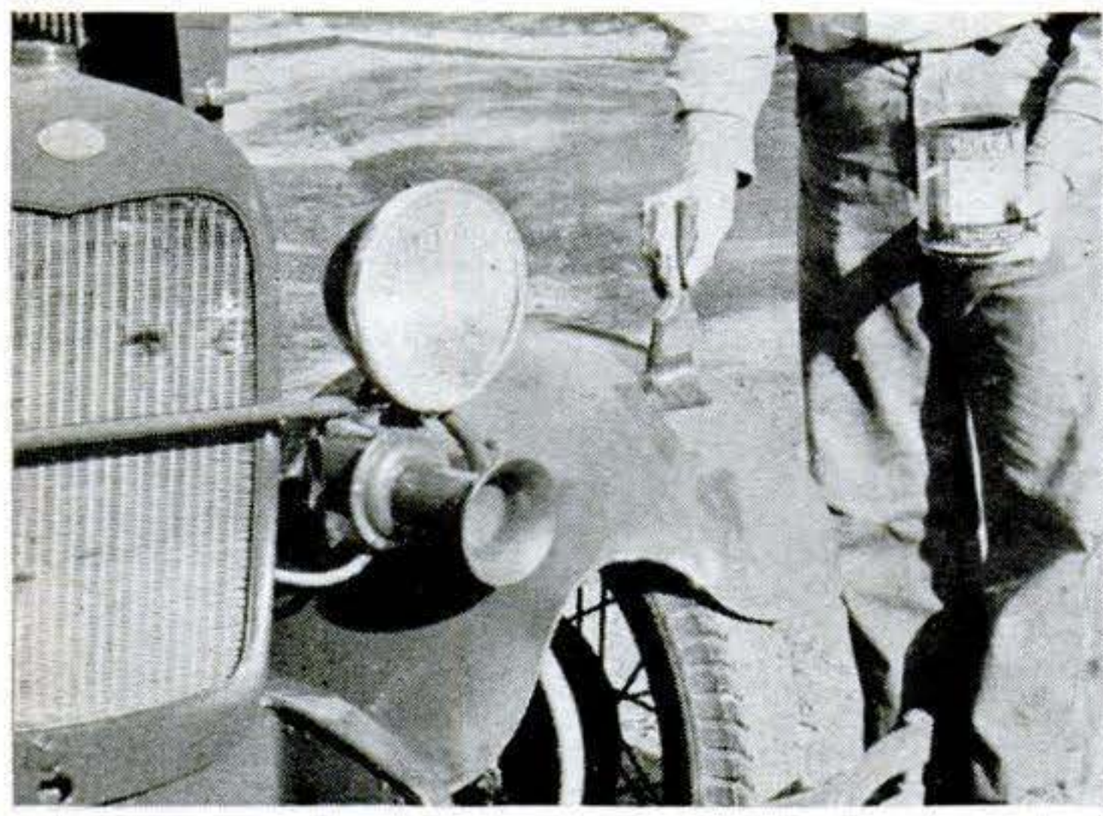
Loose rust scales were wire-brushed off. These would cause paint to peel. But it isn't necessary to get down to bare metal. Dents were pounded out with hammer and wood block.

THIS Model-A pickup was once so red with rust that everybody called it Rusty. The fenders were dented, the top torn, and the truck box worn to a sieve.

The engine still ran with vigor, but the truck was a dubious asset to the young businessmen who had bought it. They could beat out the dents, weld sheet metal in the bed, and put on a new top. But the rust would still leave it looking like a wrecking-yard refugee. To do a conventional repaint job, they'd have to take off everything down to bare metal. As one owner said, "If we sand Rusty down to shiny metal, we're not sure there'll be enough left to hang together."

What the truck needed was something that could be applied right over the rust. Talking over the problem with a paint man, Rusty's owners learned that a primer to do what they wanted was on the market.

This primer uses a fish-oil base. Fish oil



Red primer brushed on easily—right over the rust. Only one coat is required. Brand was Damp-Proof Red primer made by Rust-Oleum. When dry, it was smoothed with emery cloth.

Single coat of enamel was applied with full brush, runs being smoothed out as work progressed. Results are perfectly satisfactory for a vehicle as badly rusted as this one.

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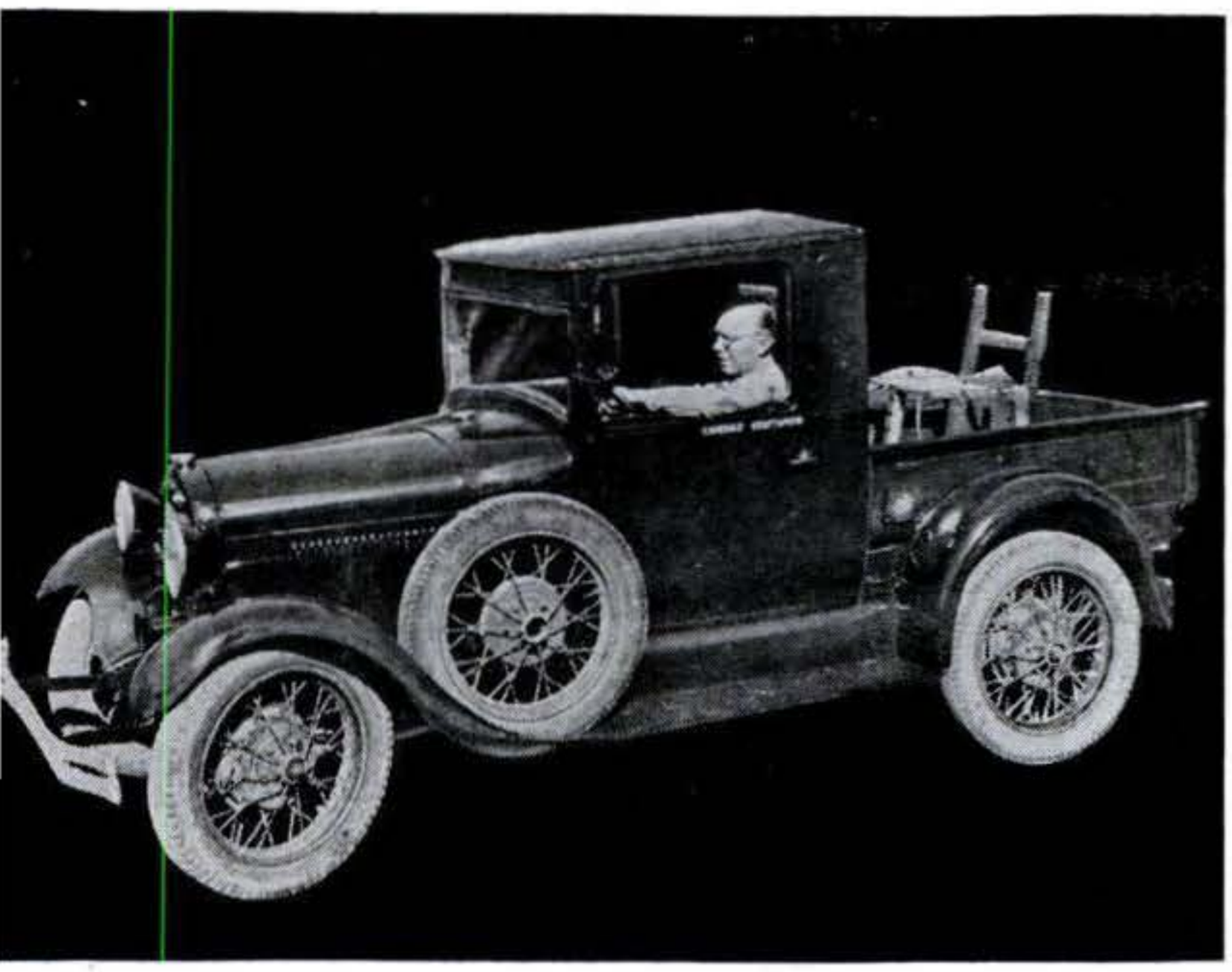
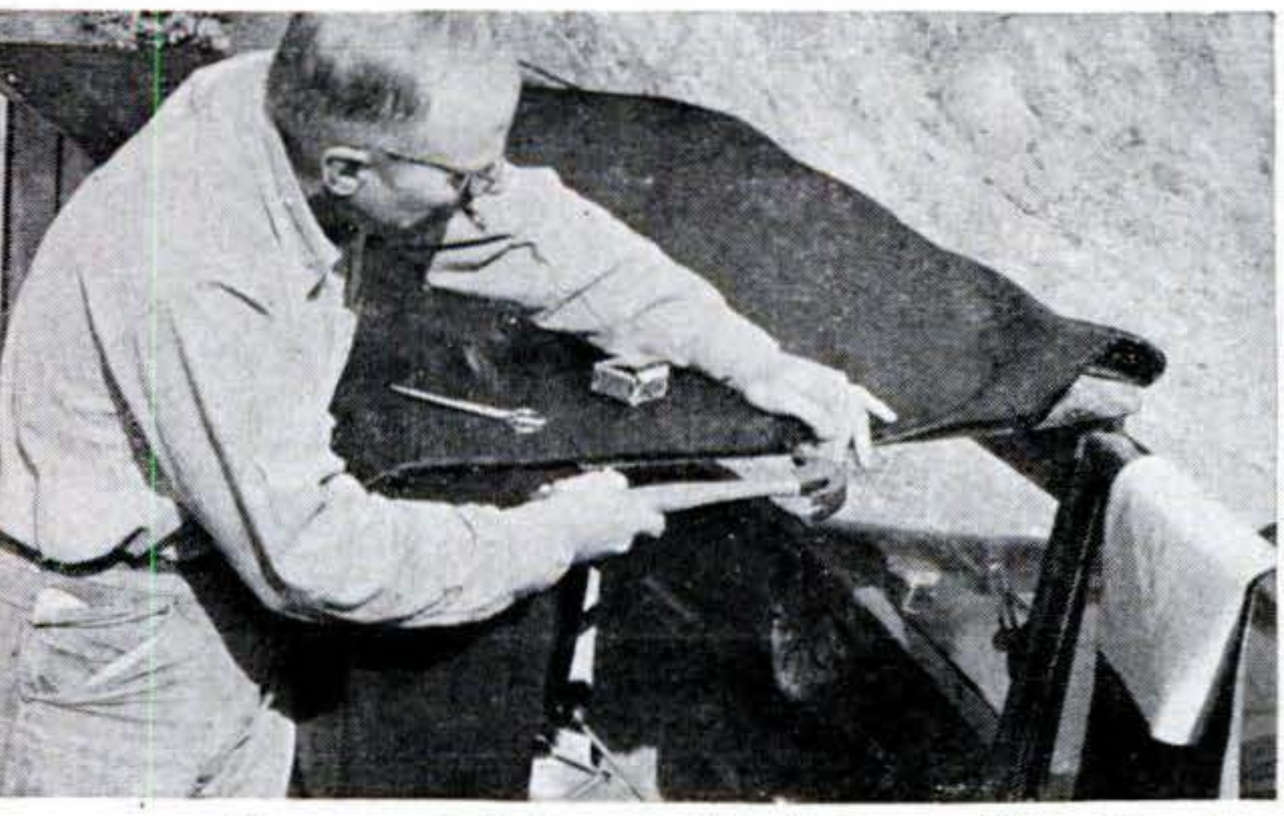


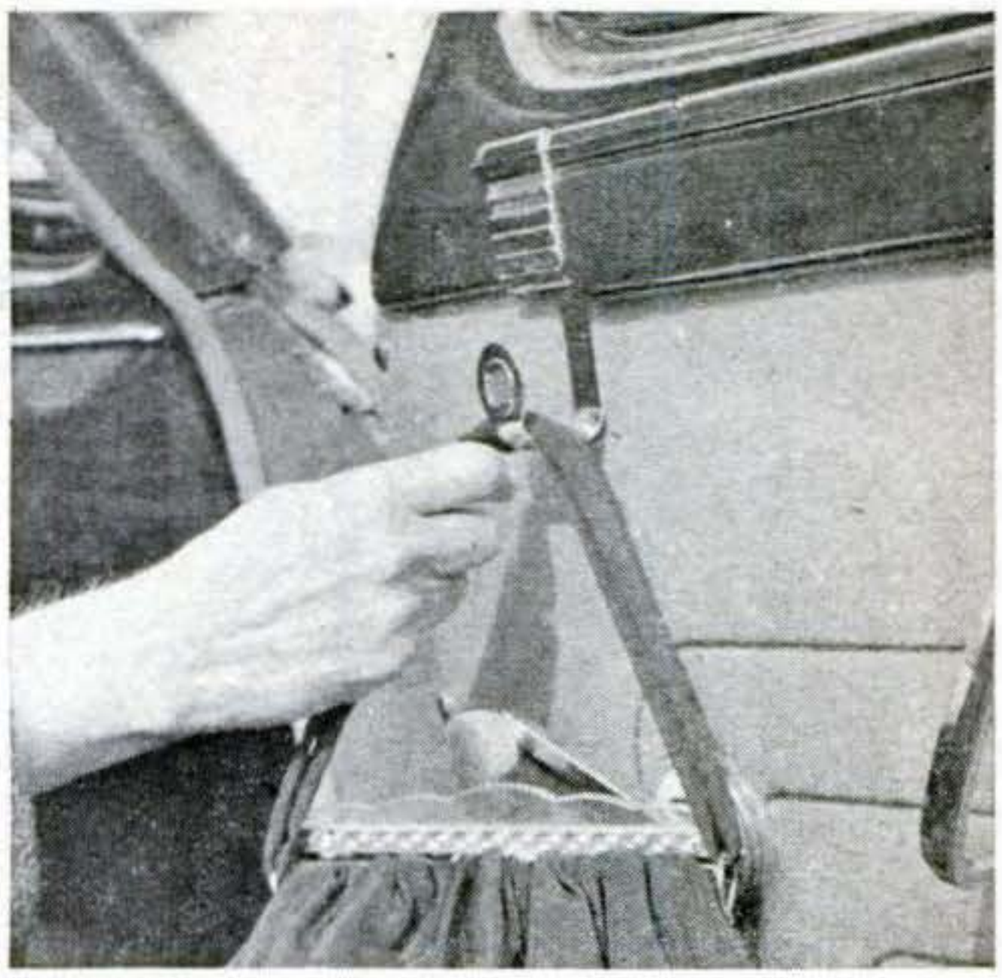
has such a low surface tension that it seeps into every pore of a hard crust of rust. It drives out air and moisture so thoroughly that it can be used on damp metal surfaces. Wrapping up the particles of rust, the fish oil makes them a part of the primer coat, stopping further rusting. This property of fish oil was discovered, incidentally, when the captain of a whaler noticed how it worked on the rust of his ship.

For the homeowner, the paint offers a way of slicking up rusty garden tools, outdoor metal furniture, and other objects subject to rust. It won't make them gleam like new auto fenders, but it doesn't call for hours of preliminary chipping.

The owners of Rusty spent less than four hours in sprucing up their truck. Three pints of primer and a quart of green implement enamel were used at the cost of a little over $7. The name is still Rusty, but the owners now have to explain why.



New top fabric was fitted, too, with a ¾" edge turned under. Tacks were first driven at middle of sides and front and back. After fabric was tight, tape was tacked around edge.



Auto Hanger Supports Handbag

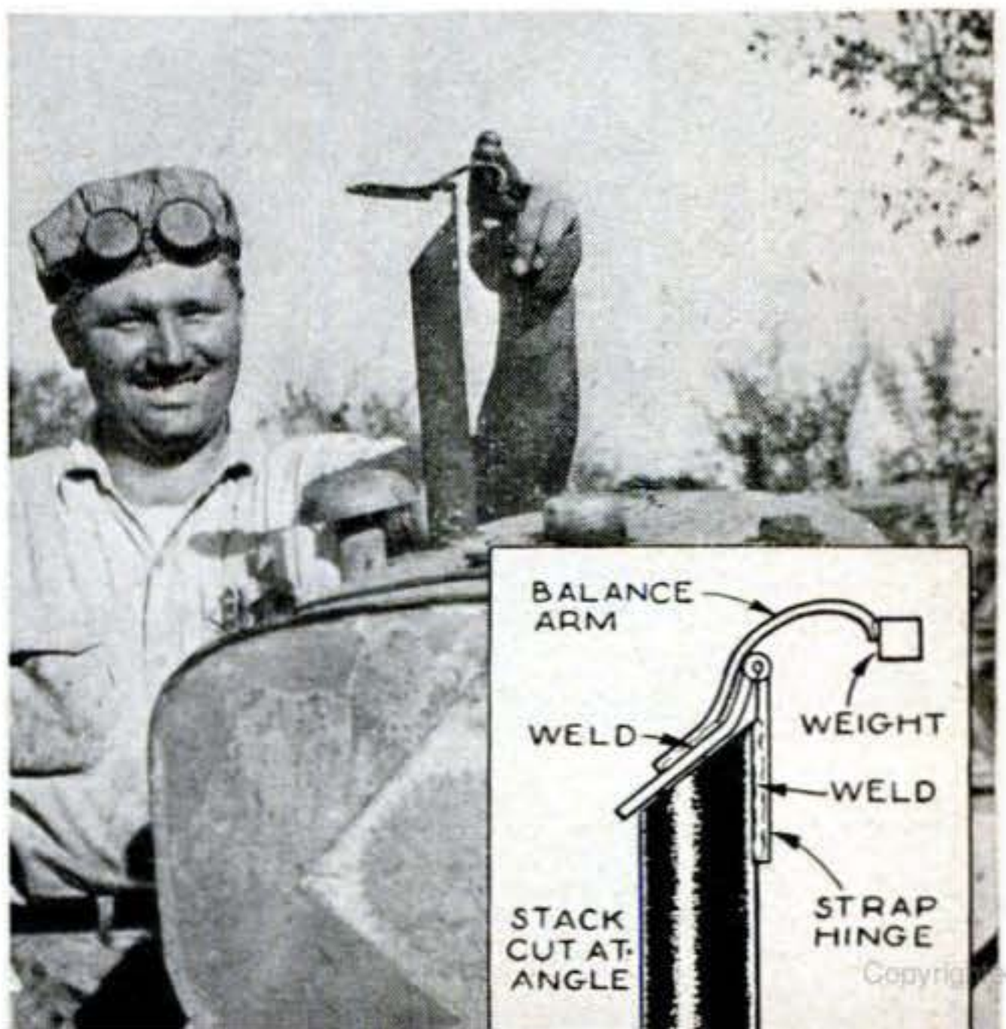
A CHROME hook that clamps under the molding below a car window can be used to hold a woman's purse or a package of cigarettes. Allen Products Corp., Detroit, sells it for about 65 cents.

Dressing Distributor Points

WHEN you clean or dress down distributor points, be sure to use a point file or fine sandpaper, not emery cloth. Emery particles conduct electricity. If any remain on the points, they may bridge the gap and cause faulty ignition.—*Elmer Pereyma, Dauphin, Manitoba.*

Flap Keeps Rain from Exhaust Stack

THIS homemade flap keeps rain out of tractor engines and stationary engines used outdoors. Properly balanced, the hinge will remain open while the engine is running, then fall shut as soon as the engine is stopped. The balance arm is curved to keep the flap from blowing open past center. J. L. and E. P. Graef, Urich, Mo., use it on their engines.



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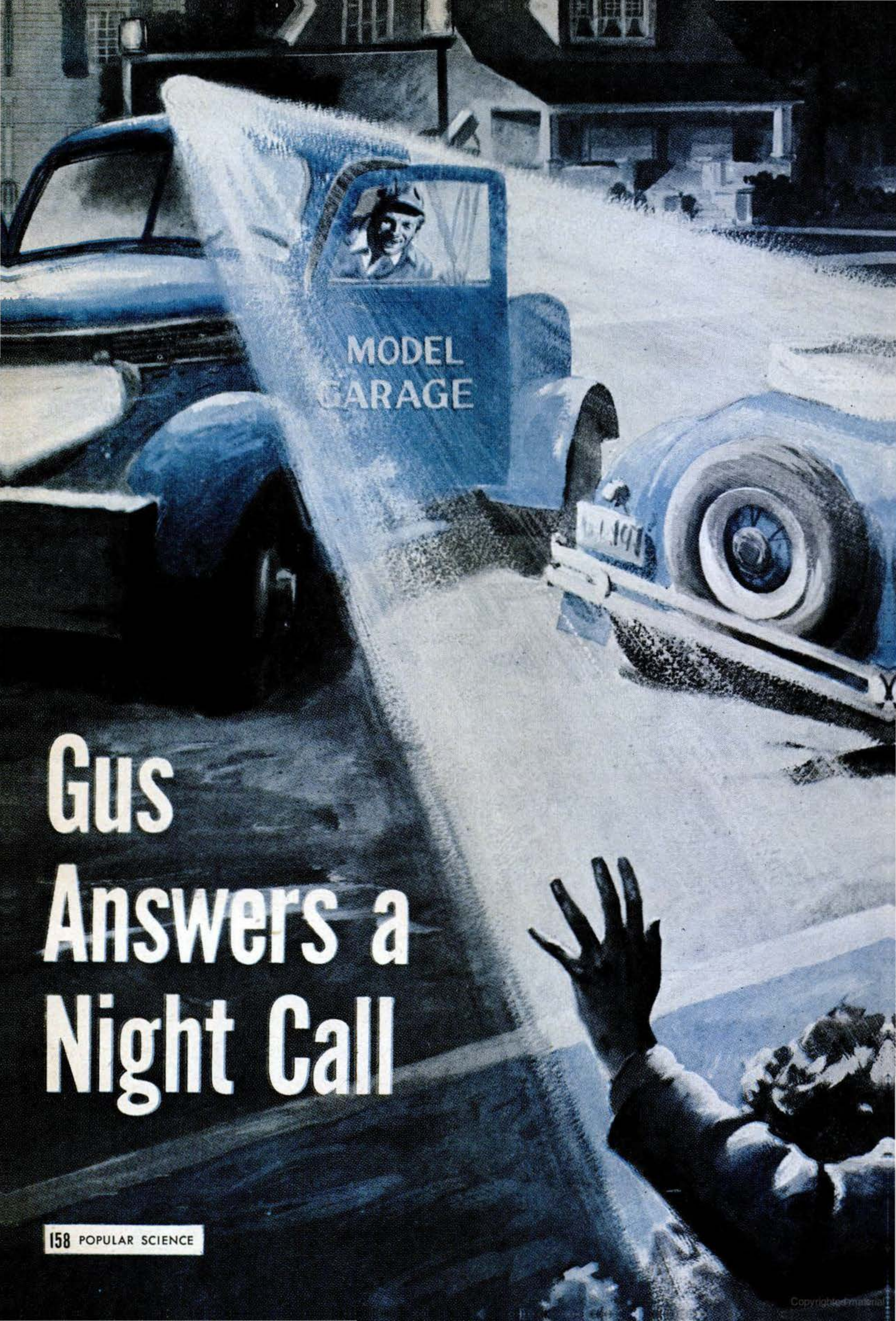

Gus Answers a Night Call

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It was more than mechanical troubles that brought Gus out to a dark, deserted street at two in the morning.

By Martin Bunn

GUS WILSON wheeled the big wrecker down the dimly lighted streets as fast as a minimum of safety would permit.

It was two o'clock in the morning, and the veteran mechanic-owner of the Model Garage was worried. Stan's frantic call for help hadn't been too coherent, and in his hurry to get started, Gus suddenly realized he had slammed down the receiver without giving his young assistant a chance to explain what the trouble was.

As Gus turned onto Maple Avenue, where Stan Hicks had said he would be waiting, he was surprised to find the houses dark and the street deserted. Then, half a block down, he spotted a familiar sight. Stan's beloved old jalopy stood by the curb, one wheel nearly hubcap-deep in a hole.

As Gus cut the wrecker's engine, he heard a strange noise.

"Psst, Gus," whispered a voice from the bushes, "over here."

Gus tried to rub the sleep out of his eyes. "Stan, is that you?"

The voice from the bushes didn't answer.

Gus Flushes First "Birdie"

Puzzled, Gus snapped on the wrecker's searchlight and swept the bushes with its beam. Suddenly the bushes parted and out burst Stan, waving wildly.

"The light," croaked Stan, "cut the light!"

Gus complied.

Stan's new white flannels were streaked with grease, and there was a jagged tear in the pocket of his sport coat.

"You look like something the cat left behind," Gus commented sarcastically.

"Gee, Boss, I didn't mean to get you out here, but I got a birdie in my car and Jane's father got mad and then I got stuck.

Gus tried to control himself. "Now what's a birdie got to do with—"

"Shhh," broke in Stan. "This is Jane's house, and if her father hears me again tonight I'll really get it."

"All right," said Gus, lowering his voice, "what's wrong with your engine?"

"Nothing," explained Stan, "I just don't

Gus snapped on the wrecker's searchlight and swept the bushes with its beam. "Stan, is that you?" he called.

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want to start it up because it'll make too much noise."

Gus glared.

"That's how I got into the hole," Stan continued. "Last night we got in a little late, and that noise in my car woke up Jane's father. He hit the roof. So tonight I figured I'd just cut the engine, coast up here, then roll her back down the hill when I left. Only I didn't see this hole and backed right into it."

Gus Helps the Hard Way

Gus looked down at his feet that were still wearing bedroom slippers. "Okay," he said resignedly, "hook on the chain and I'll tow you out."

"No, no," yelped Stan, "that's worse. It'd be sure to wake up the old man. I was almost able to rock her out. Maybe the two of us—"

Gus started to say something, then thought better of it and silently eased his big shoulder against the trapped jalopy. Together the two pushed and heaved until finally the car rolled out.

"Now back down easily," directed Gus, "and try not to hit any more holes. I'll coast down behind you."

At the bottom of the hill, Gus pulled up beside the roadster as Stan started the engine. Stan had a birdie all right. It was a high-pitched screech coming from under the hood that didn't sound quite like anything Gus had ever heard.

"Well," announced Gus, "we'll tackle that screech owl in the morning. I'm going back to bed."

Stan turned to offer his thanks, but the big wrecker was already rattling off.

Dawn Brings New Troubles

Gus was a little late arriving at the Model Garage the next morning, and when he got there Stan was hard at work.

Stan looked up and greeted the master mechanic with an embarrassed grin. "Gee, Boss, I'm sure sorry about last night. I—"

"Forget it," cut in Gus. "But I think we'd better clip that birdie's wings before you lose Jane and I lose any more sleep. Why didn't you tell about it sooner?"

Stan looked sheepish. "Well, Jane's been kidding me about a mechanic who can't even fix his own car, so I've been determined to find it myself."

"Well, two heads never hurt anybody," quipped Gus, "unless they're on the same shoulders. How long have you had it?"

Birdie Sings in Reverse

"Several days now," replied Stan, "and it keeps getting worse all the time. Funny thing, though, instead of getting louder the faster you go, it quiets down. It's loudest when the engine's idling."

"Well, let's take a listen," said Gus, as he walked over to Stan's roadster and opened the hood. "Start her up."

Just as Stan had said, the engine took hold to a shrill, high-pitched screech, then as Stan gunned the engine, the noise seemed to diminish rather than increase.

Gus motioned Stan to cut the engine. "What have you done so far?"

"Everything I could think of. I checked the fan belt, water-pump bearings, and generator bearings. All okay."

"How about the distributor?" asked Gus, remembering the squeaky cam they had found on Doc Rhodes' car a few years ago.

"Yup, checked that, too," said Stan wearily. "I just don't see what could—"

Stan was interrupted by the blast of a car horn outside.

"I'll get it," offered Gus. "You better look at the generator again and this time check the brushes."

Bird Population Increases

A few minutes later, Gus returned grinning from ear to ear. "This seems to be our day for bird hunting. Ted Trimble's outside with another canary."

"Oh, no," groaned Stan.

"We'd better give him a hand with his," advised Gus, "and maybe we'll learn something."

"Just listen to this," grumbled Ted, as the pair walked up to Ted's blue sedan.

As the engine idled, a rhythmic chirp, chirp, chirp came from the engine.

"Step on the gas a little," suggested Gus.

Ted complied, and the chirps speeded up, keeping time with the engine.

Methodically, Gus checked the tension

[Continued on page 216]

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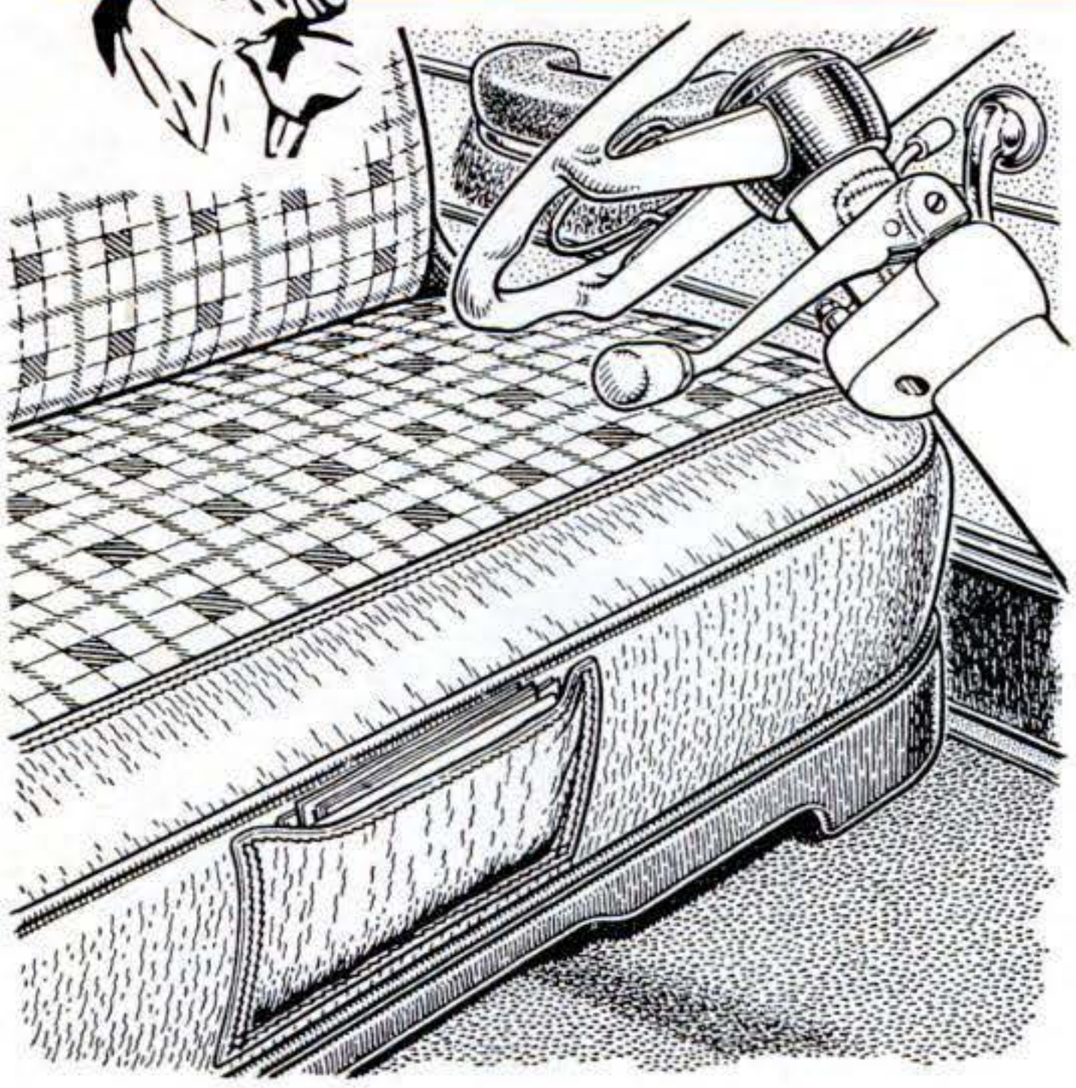
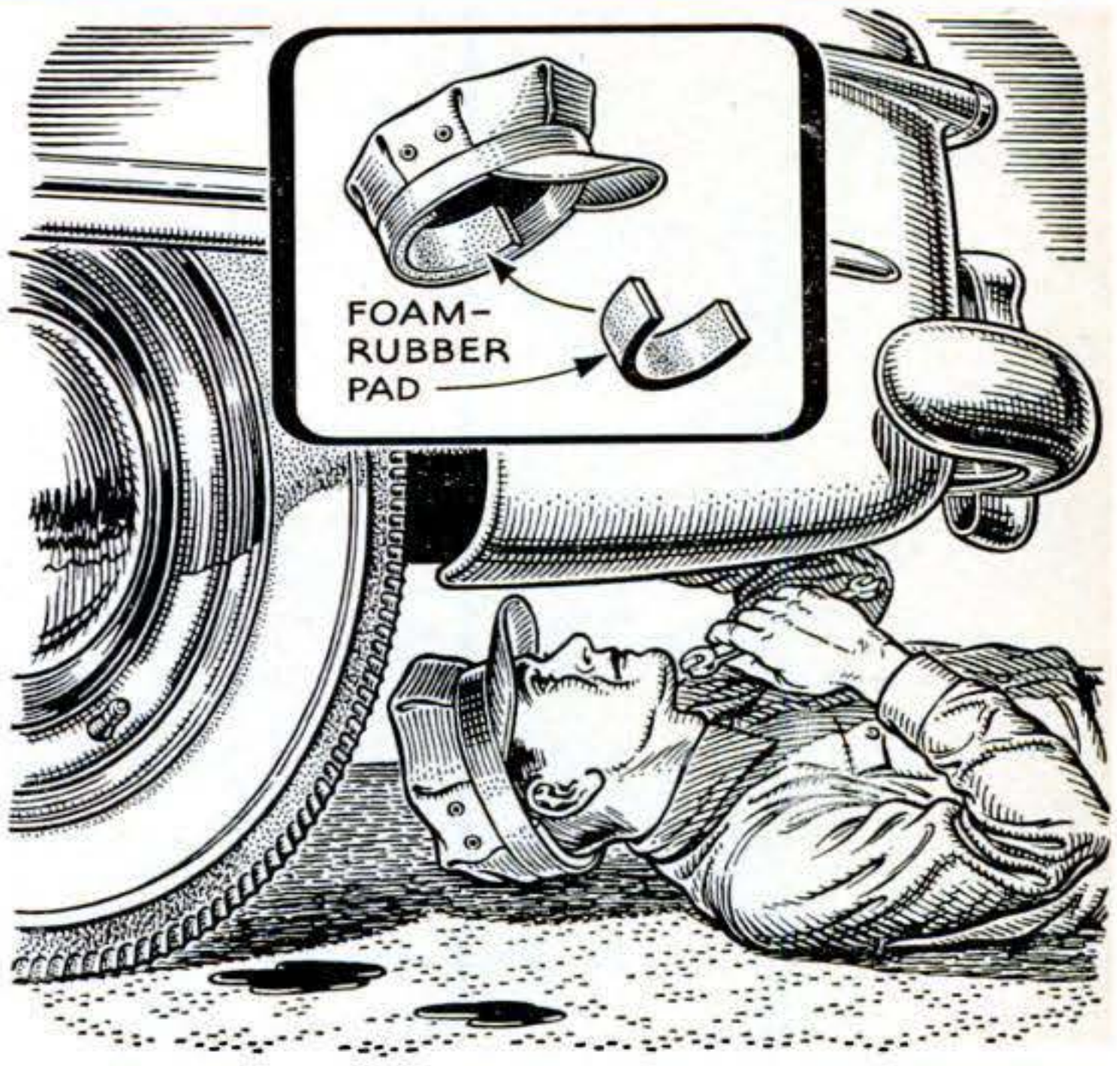
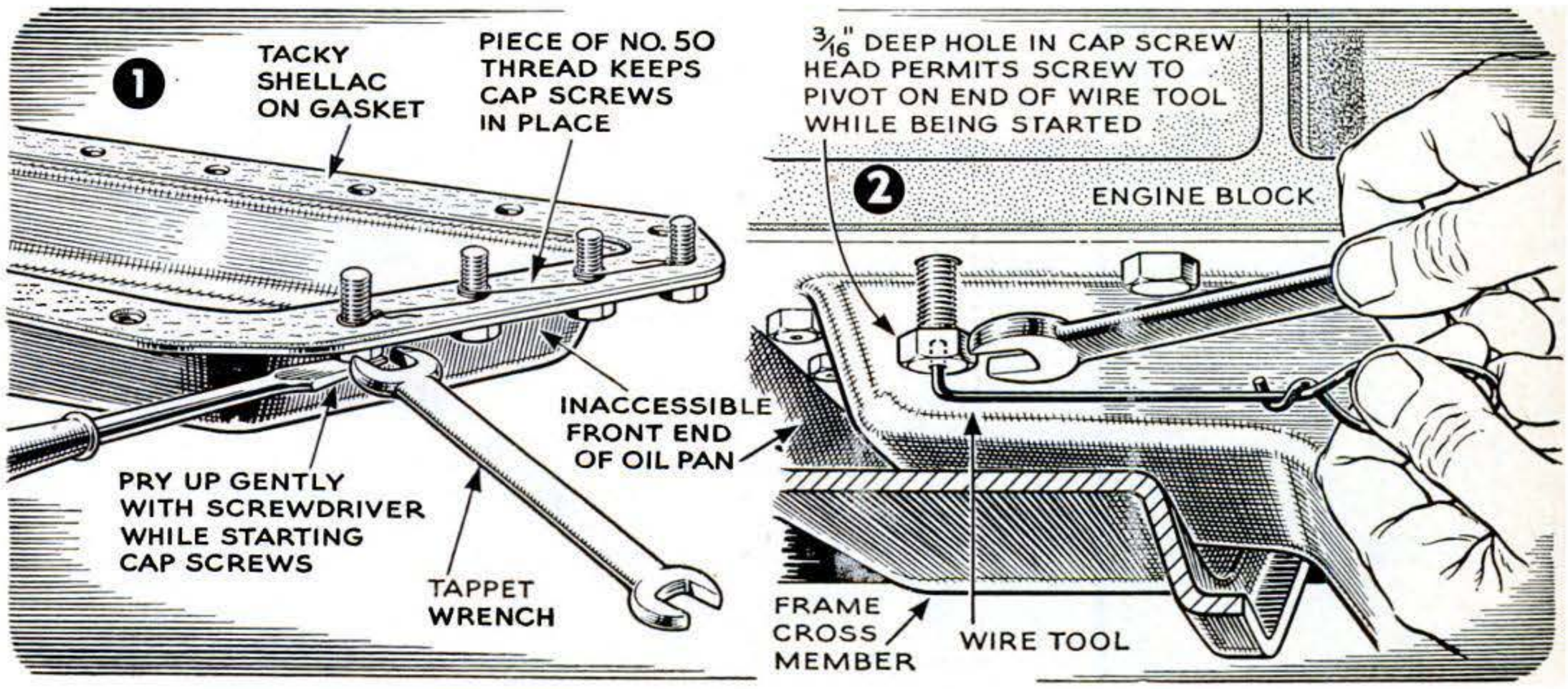
Hints from the Model Garage





Unloading the Glove Compartment. A pocket sewn to the seat cover like this makes a handy place to keep maps and other bulky papers. Centered, it won't be in anybody's way. For appearance, try to make it of the same material as the covers.

Keep This Under Your Hat. One mechanic solved the head-on-floor problem by stitching an oblong piece of foam rubber inside an oversize shop cap. This makes a pillow for his head when he crawls down under. It also keeps dirt out of his hair.



How to Replace an Oil Pan. Some shop manuals give you this advice: "Unbolt front engine mounting and jack up engine." That gives you room to hold the front cap screws while you start them.

But H. M. Springstun, of Payette, Idaho, and Marion L. Rhodes, of Knightstown, Ind., wanted an easier way. Springstun came up with method No. 1 and Rhodes with method No. 2, both illustrated here.

In No. 1, a thread is used to hold the screws while you start them and then is left in place. Tightening the screws seals it into the gasket. In No. 2, a tool made from coat-hanger wire slips loosely into holes drilled in the heads of the screws.

Turn the page, please, for four more auto hints.

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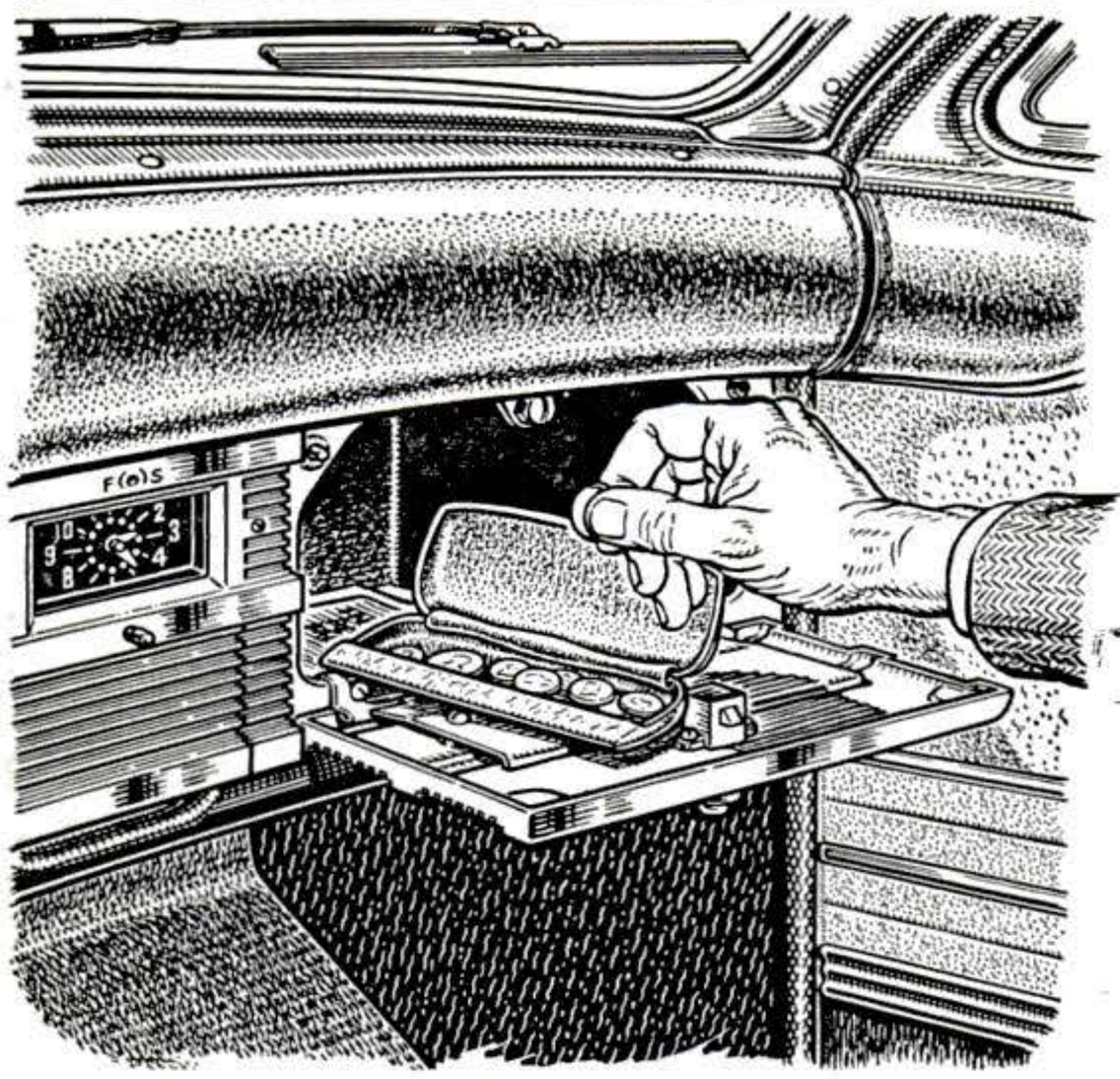
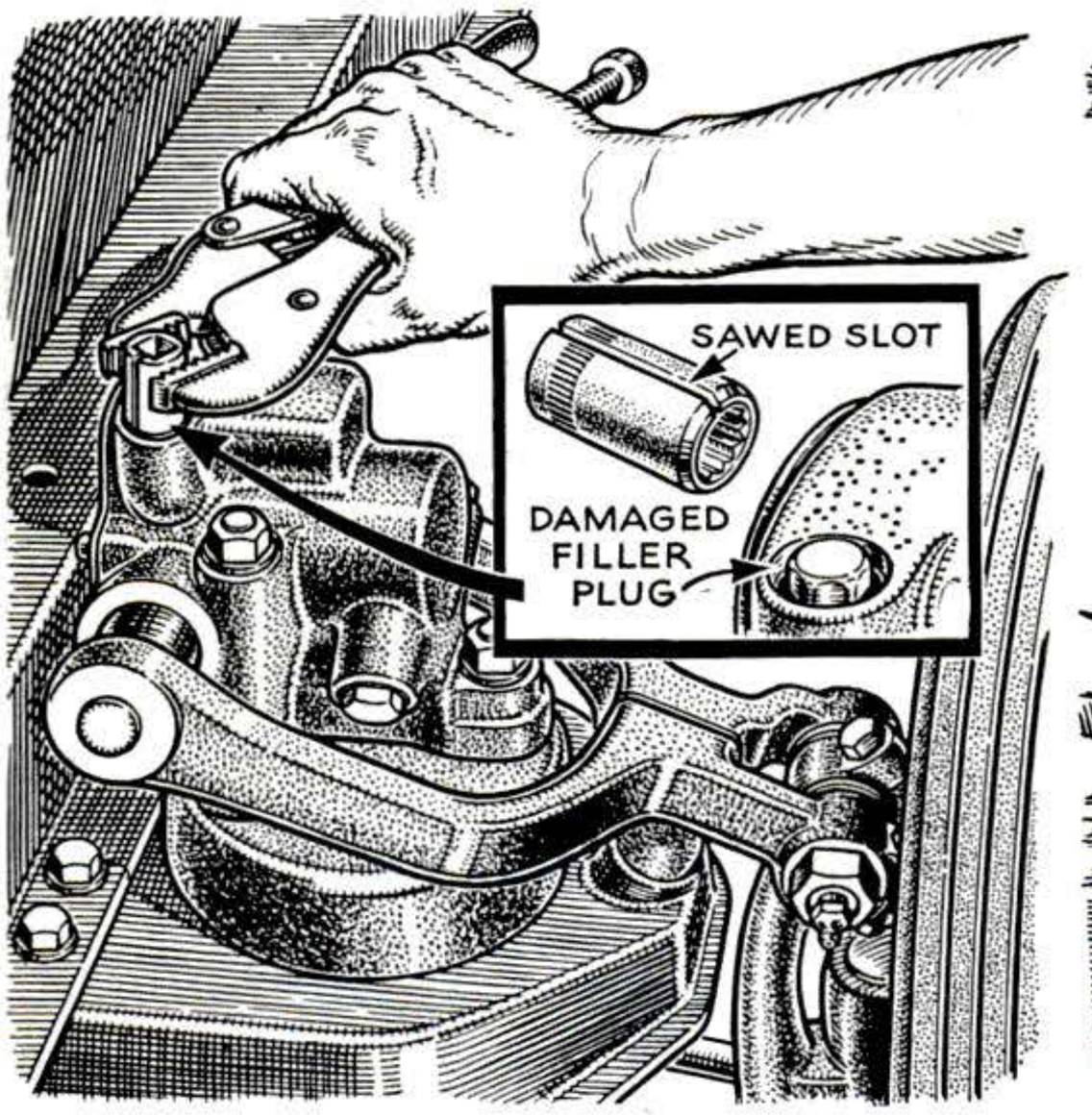
MORE Hints from the Model Garage

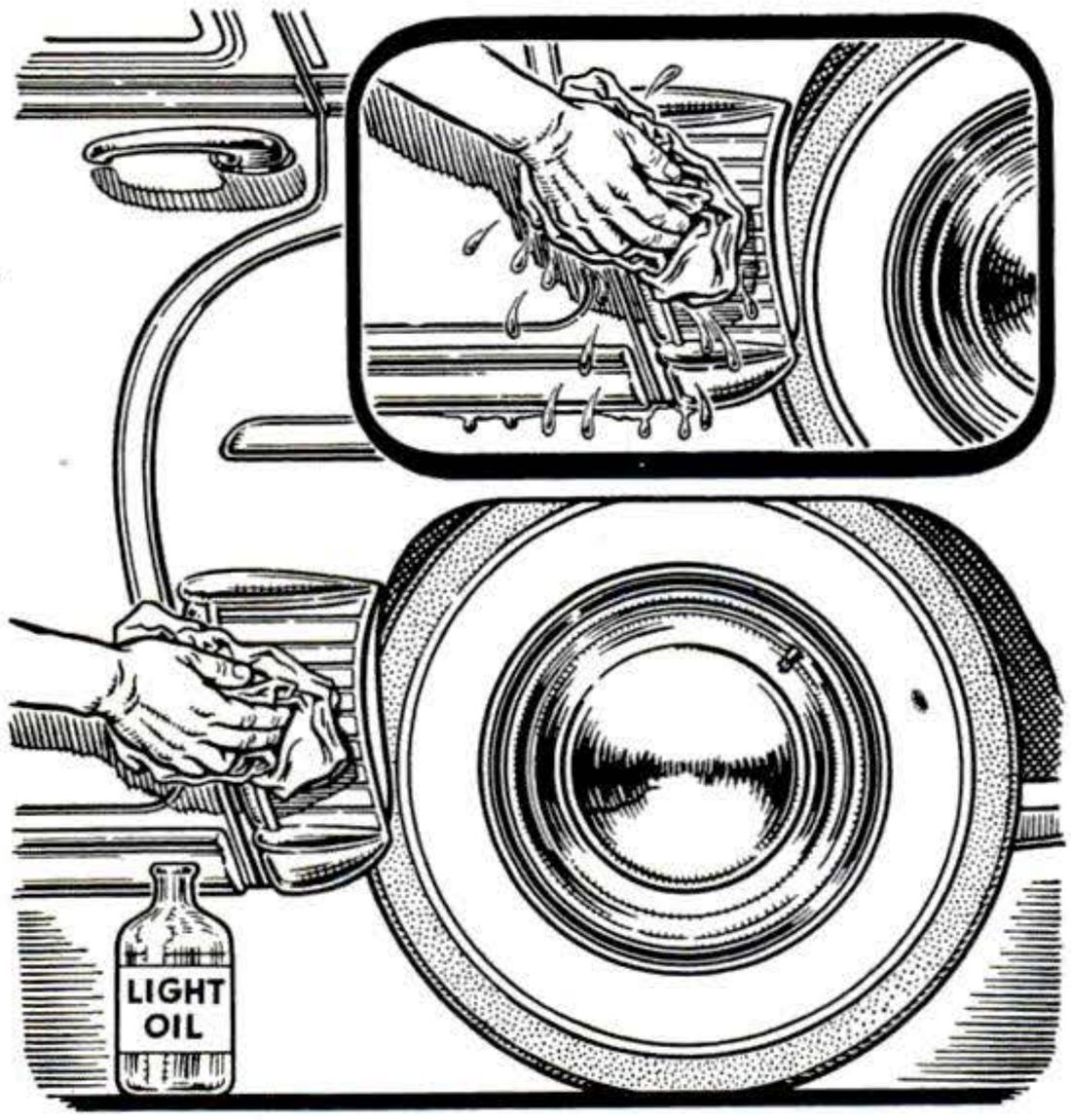


Glasses Case Holds Meter Change. A snap-lid case kept in the glove compartment makes a handy container for the nickels and dimes you need while driving. The case serves as a camouflage, too, for who wants someone else's glasses?

Flashlight Helps Spot the Jack. A flashlight clipped to the side of a shop jack like this will help locate the jack under a car, especially when light is bad. The clip can be screwed to the jack frame or tack-welded in place.



Removing Shock-Absorber Plugs. On some shock absorbers the head of the filler plug is recessed. If the corners of the hexagonal plug head round off, you've got a problem. A socket wrench won't hold. One solution is to hacksaw through one side of a spare socket, slip it on the plug, and squeeze it tight with a vise-grip wrench.



How to Protect Chrome. To prevent rust, apply light oil after each washing and wipe away surplus. The American Electroplaters Society recommends such washing and oiling at least three times a winter if salt is used on highways. To remove rust that has formed, use any scouring powder that is safe on porcelain or tile.

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Plastic Wing Stops Wind Whistle

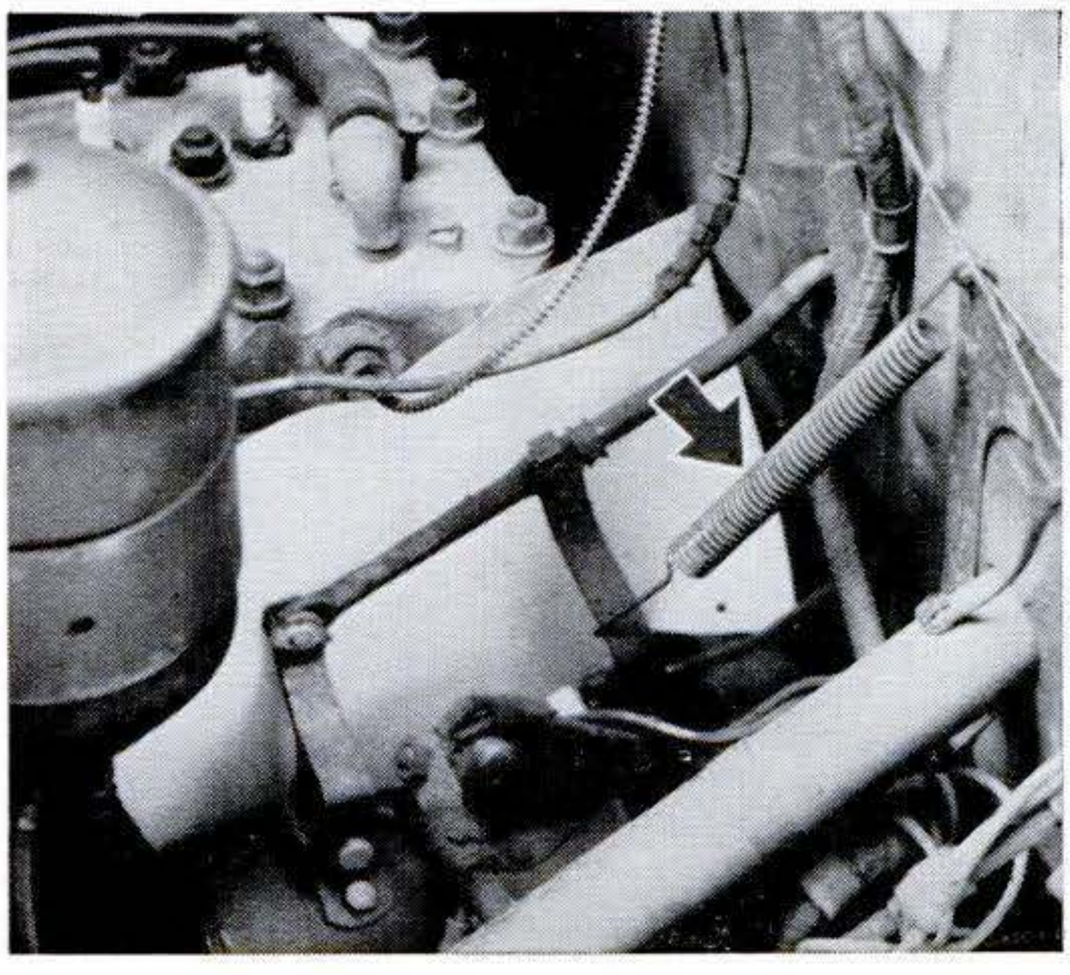
WHEN a car's vent windows are open, the wind often makes an annoying whistle at high speeds. Clipped to the window division bar, this Wiss-L-Stop is claimed to cut down wind noise. Allen Products Corp., Detroit, markets the accessory for about $1.50 a pair.

Compound Cleans Off Undercoating

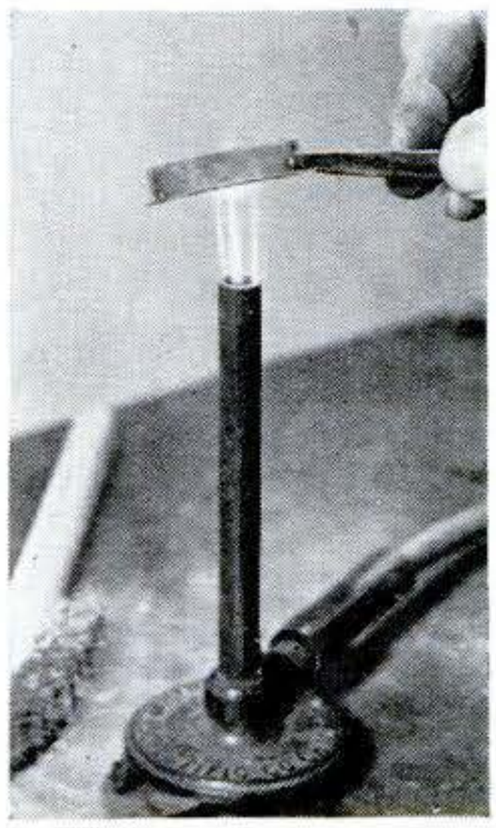
IF UNDERCOATING is carelessly sprayed on a car's bumpers or fenders, get it off with painters' rubbing compound. Go easy on painted areas.—*J. H. Sweitzer, Newell, Pa.*

Coil Spring Disengages Starter

IF THE starting-motor return spring breaks on an older car, you can usually mount a coil spring as below for an emergency replacement. A fairly heavy coil is needed.—*Clinton R. Hull, Costa Mesa, Calif.*

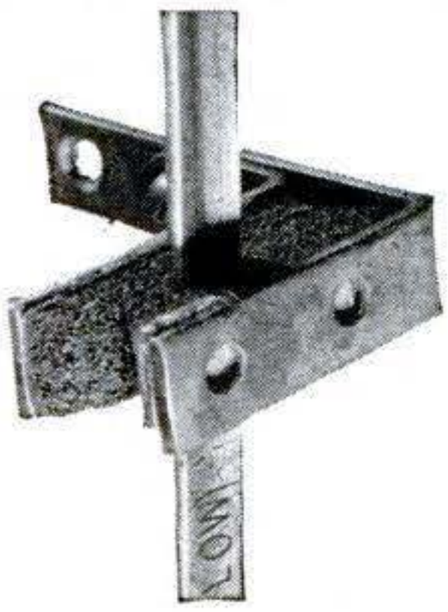


Heat Cleans Gum from Choke Strainer



IF SOLVENTS won't clean gum from the fine-wire strainer in an automatic choke, try holding it in a blue gas flame until the metal almost glows. (Be sure it isn't soldered to its ring.) After the metal cools, you can sweep out the dirt with a stiff brush. —*Walter E. Burton, Akron, Ohio.*

How to Make a Dipstick Wiper



CEMENT weatherstripping between two angle brackets bolted together like this, mount the assembly in the engine compartment, and you have a very handy dipstick wiper.—*David Findlay, Brooklyn, N.Y.*

Tape Roll Acts as Third Hand

TO SUPPORT your flashlight for roadside repairs, try forcing the end through a roll of tape. This will often do the trick and put light exactly where you want it.—*H. Leeper, Canton, Ohio.*

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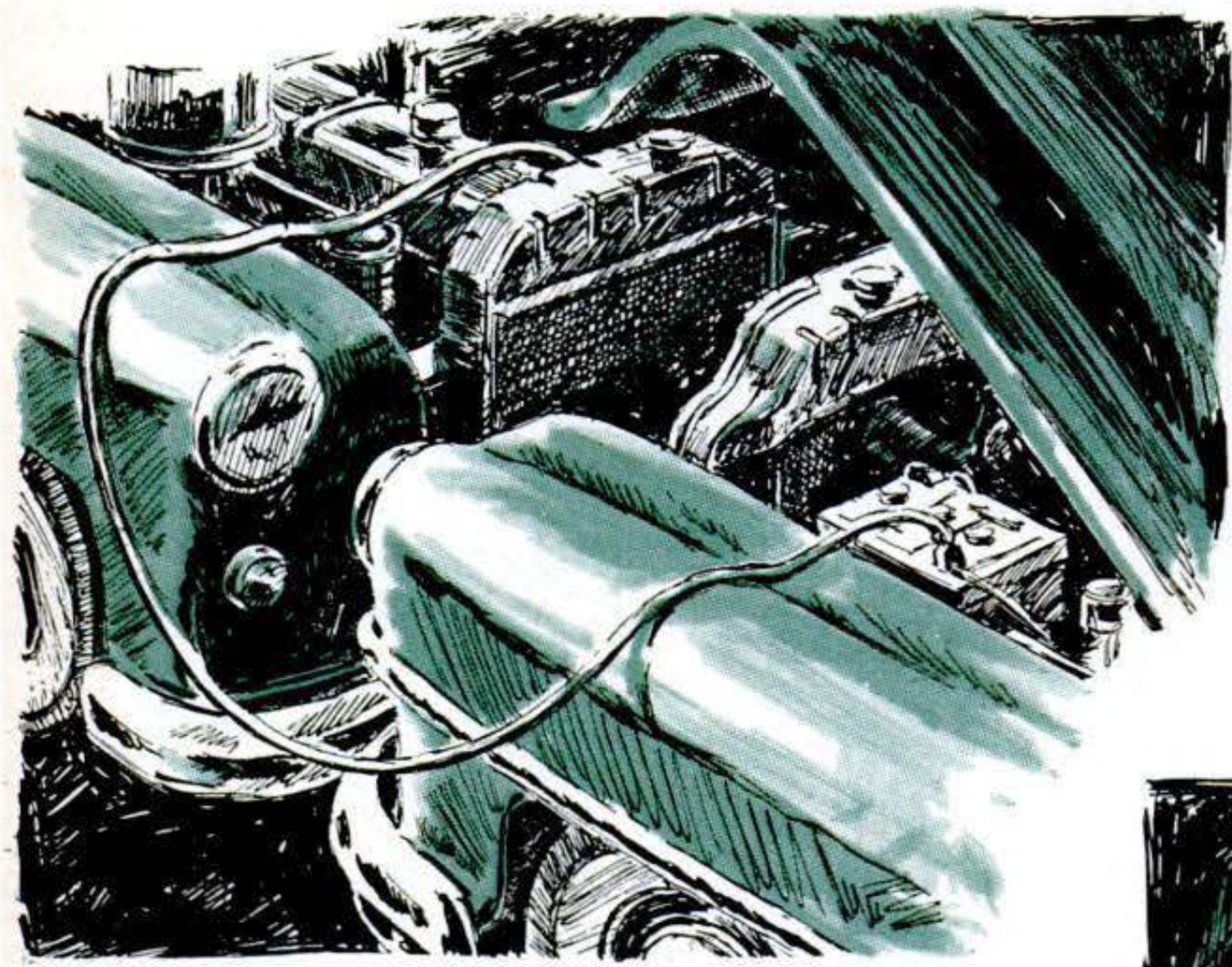
For Roadside Emergencies



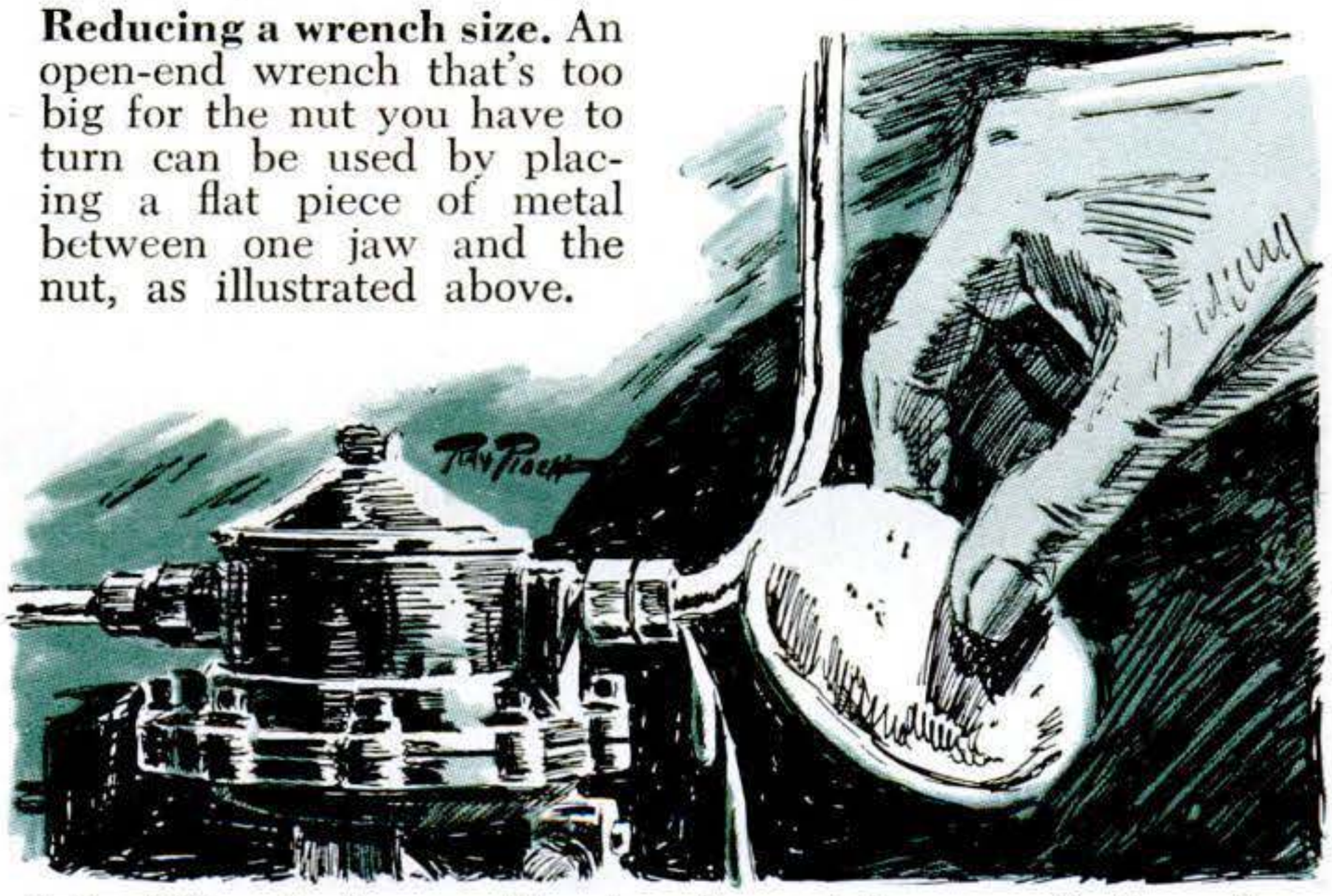
Borrow juice from another battery if yours is run down. In setup above, heavy cable joins ungrounded terminals; bumpers touching each other complete circuit. This trick works only when both cars have the same pole grounded. Heavy cable will pass enough current to turn starter of stalled car. If you can't scrounge heavy enough wire, use the best you can and wait until live battery boosts weak one. Run engine of "donor" car to keep up its battery.

If you run out of gas, you will save the battery by priming system instead of waiting until the starter draws gas from the replenished tank. Save half a cupful, remove the air cleaner, slop gas into the carburetor, and hit starter fast.

If headlamp goes out, corrosion on the contacts might be all that's wrong. Remove lamp and clean contacts with wire brush. This trick may save you the cost of a new sealed-reflector unit.

Temporary fan belt can be made from rope. Cut it a bit longer than required loop, unravel the strands at each end, splice by interbraiding the strands, and wrap splice securely with tape.

Reducing a wrench size. An open-end wrench that's too big for the nut you have to turn can be used by placing a flat piece of metal between one jaw and the nut, as illustrated above.



A fuel-line leak can often be plugged temporarily by softening a piece of soap and forcing it into the split.

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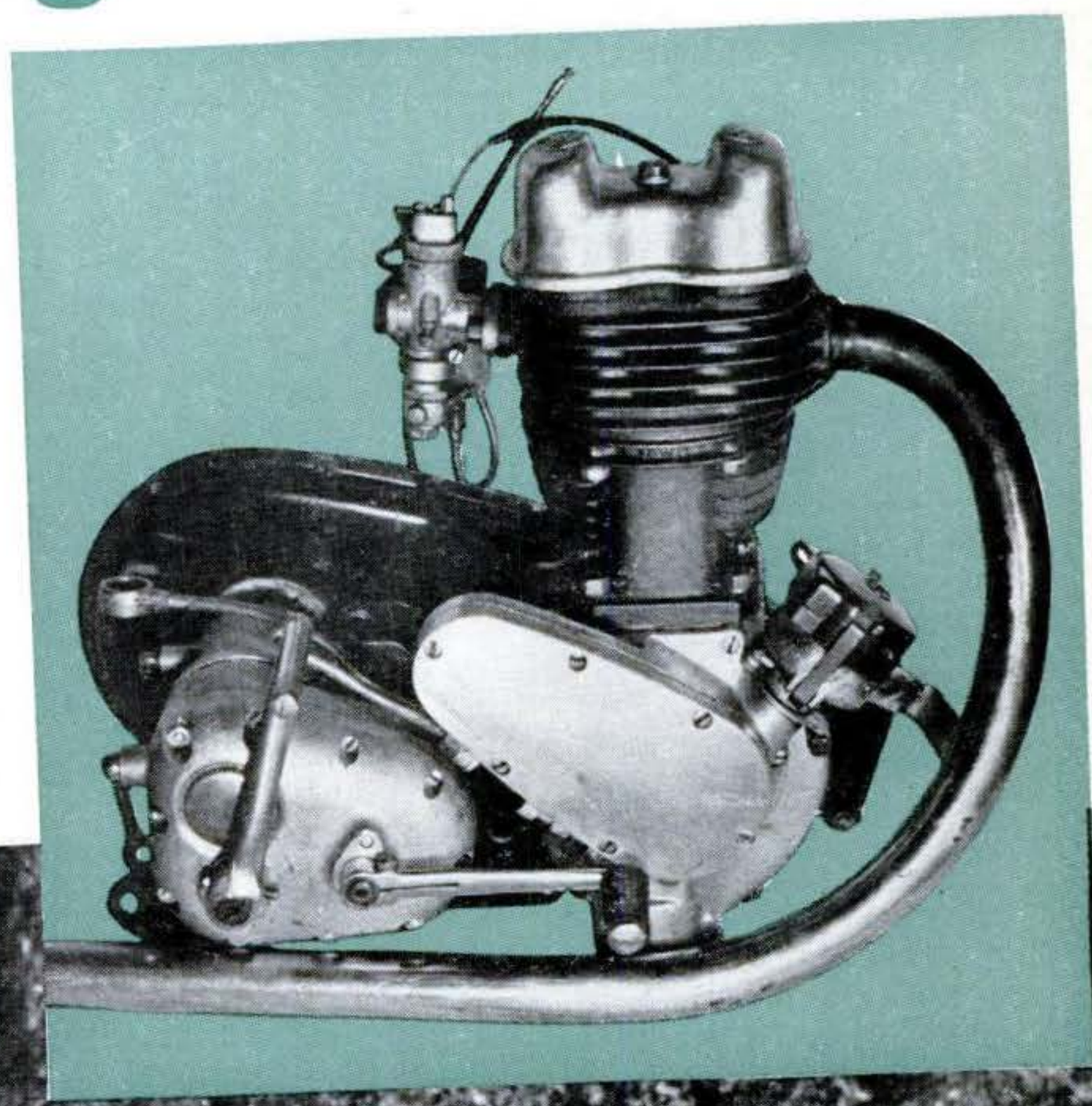
How I Built My One-Lung Racer

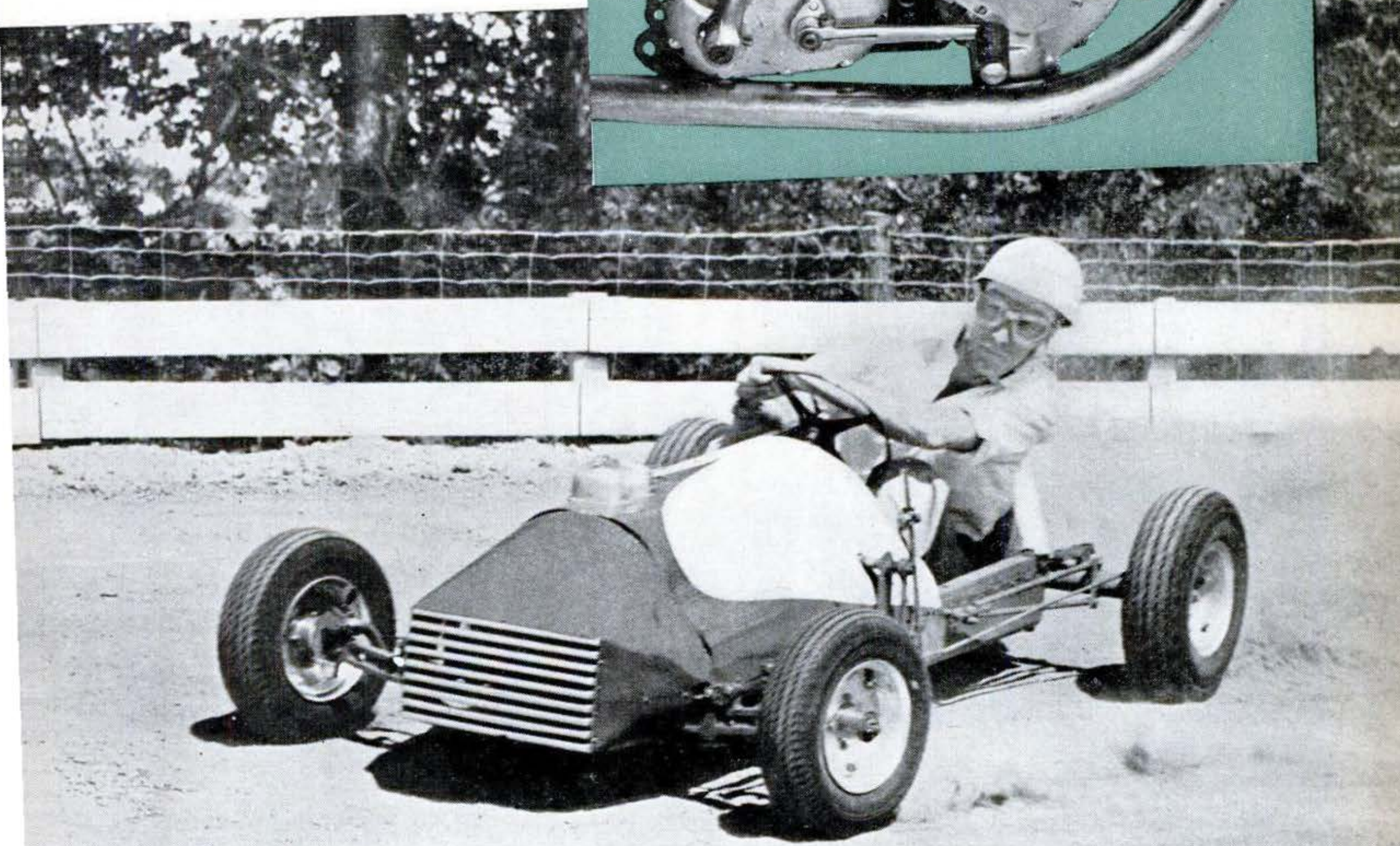
You can combine craftsmanship with sport in micromidget racing. Here is how to get started.

By John Rogers
Member, Dallas Micromidget Racing Club

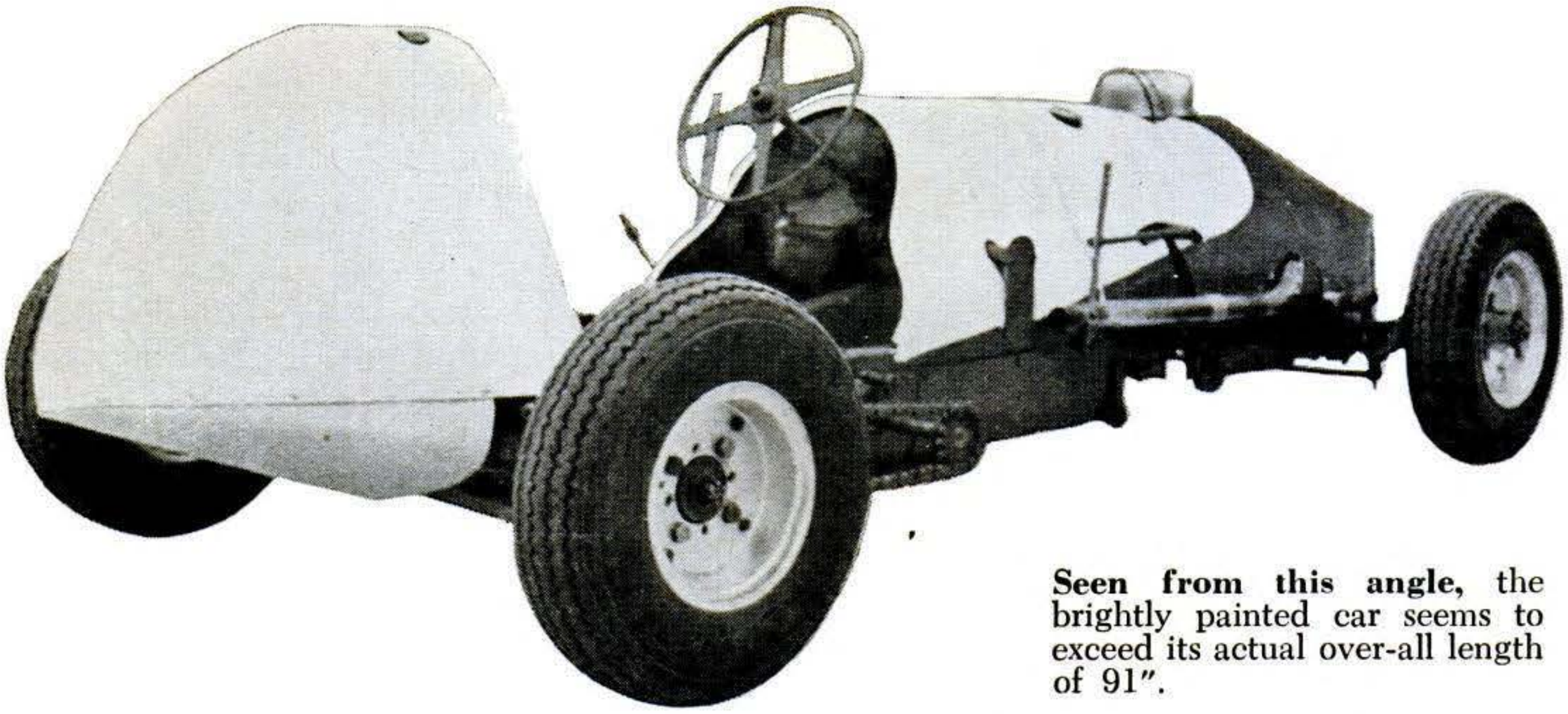
WHEN you broadside into an oil-slicked turn in a one-cylinder midget, sitting inches from the ground, you know you've really been in something. The cars are small, but the thrills are as big as any you'll find at Indianapolis. We couldn't resist



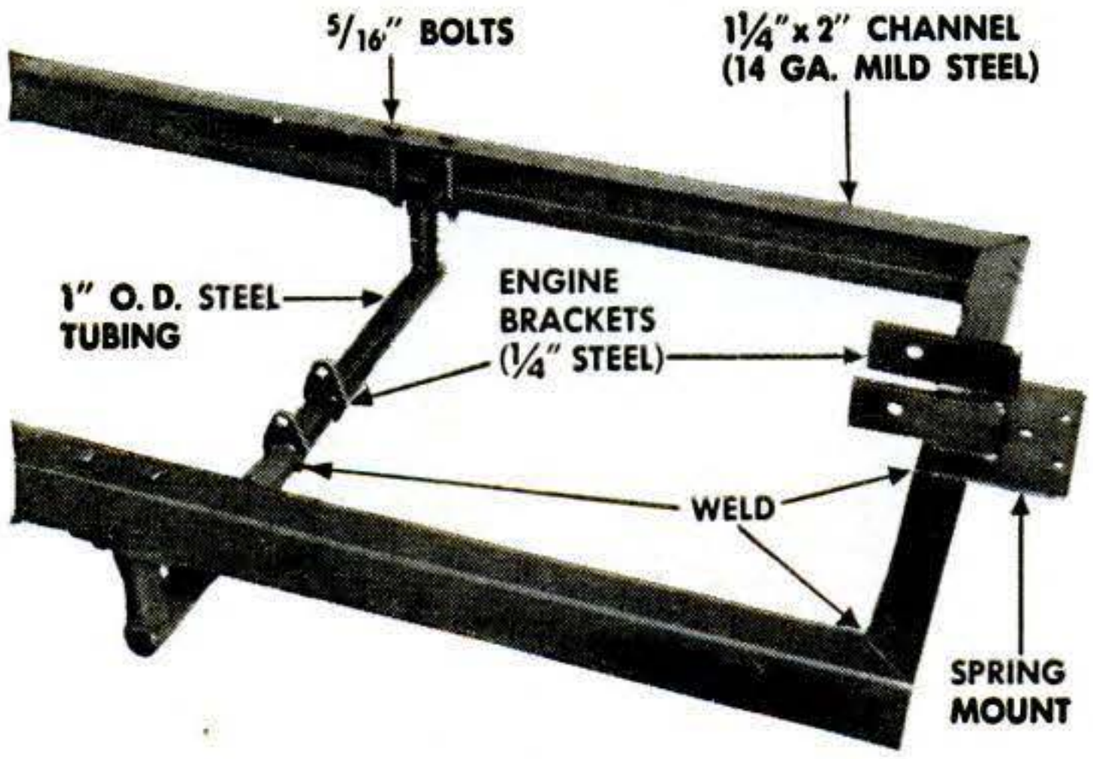
Power plant is a B.S.A. Model C-11, a 15-cu.-in. overhead-valve air-cooled British motorcycle engine. Turning up at 5,400 r.p.m., this engine kicks out 11 bhp. Built-in three-speed transmission and clutch make it ideal for midget-car building. Assembly has a kick starter.



John Rogers stirs up dust as he broadsides in his homemade midget. Top speed is around 60.



Seen from this angle, the brightly painted car seems to exceed its actual over-all length of 91".



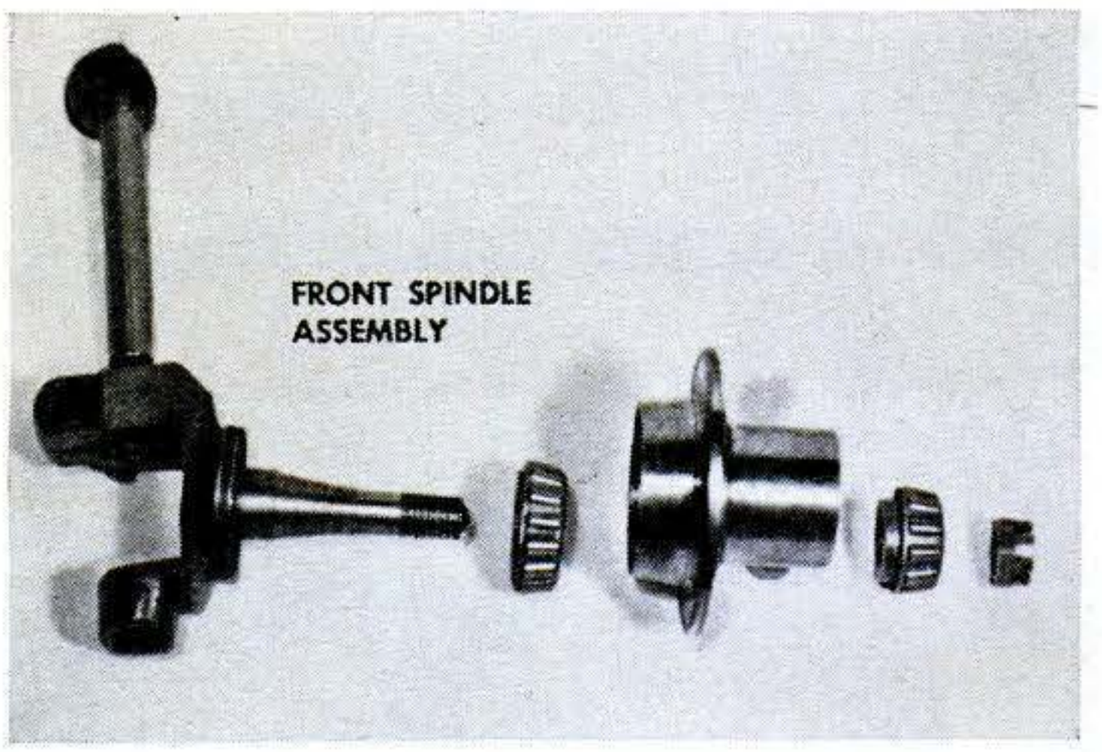
Frame measures 20" by 60". Midget has a 62½" wheelbase. Front and rear spring mounts are ⅛" steel plate welded to top of frame. Two ⅜" bolts hold engine to the supports.

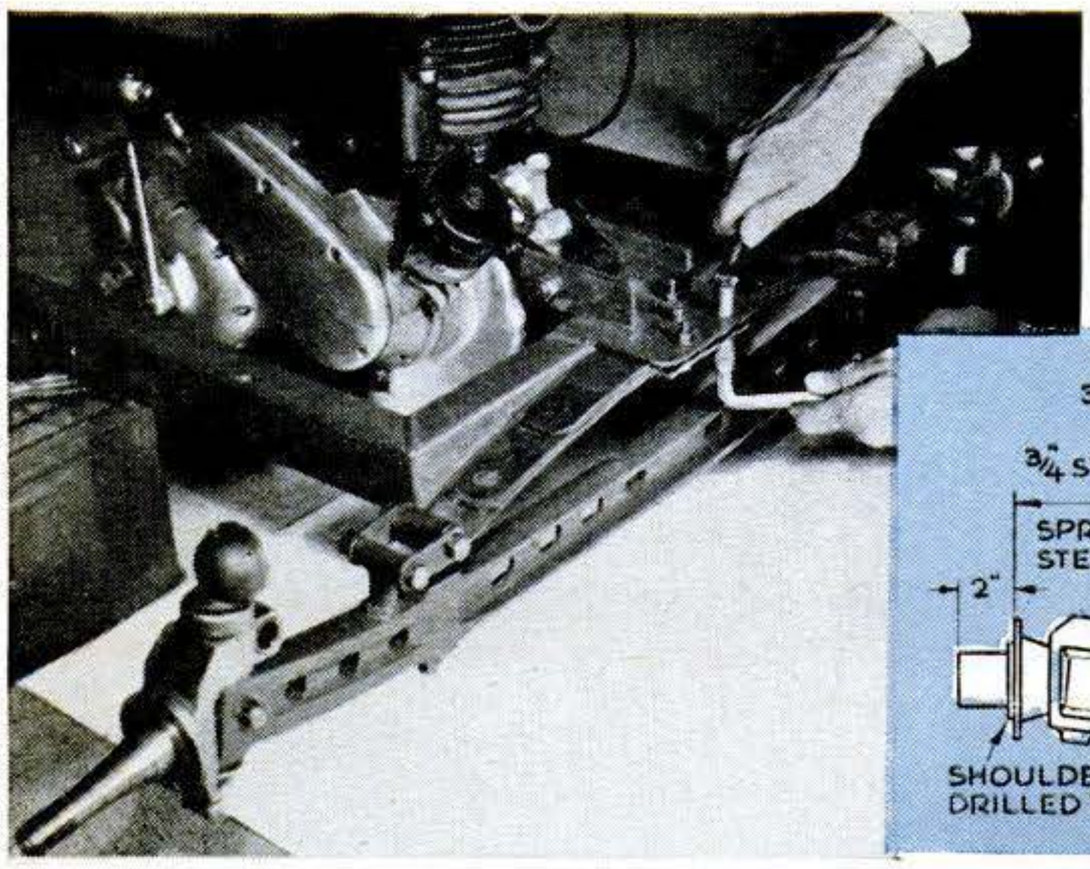
taking a crack at the sport after reading in POPULAR SCIENCE about the fun that Indiana club had ("Homemade Racers Hit the Dirt Track," Oct. '49, p. 186).

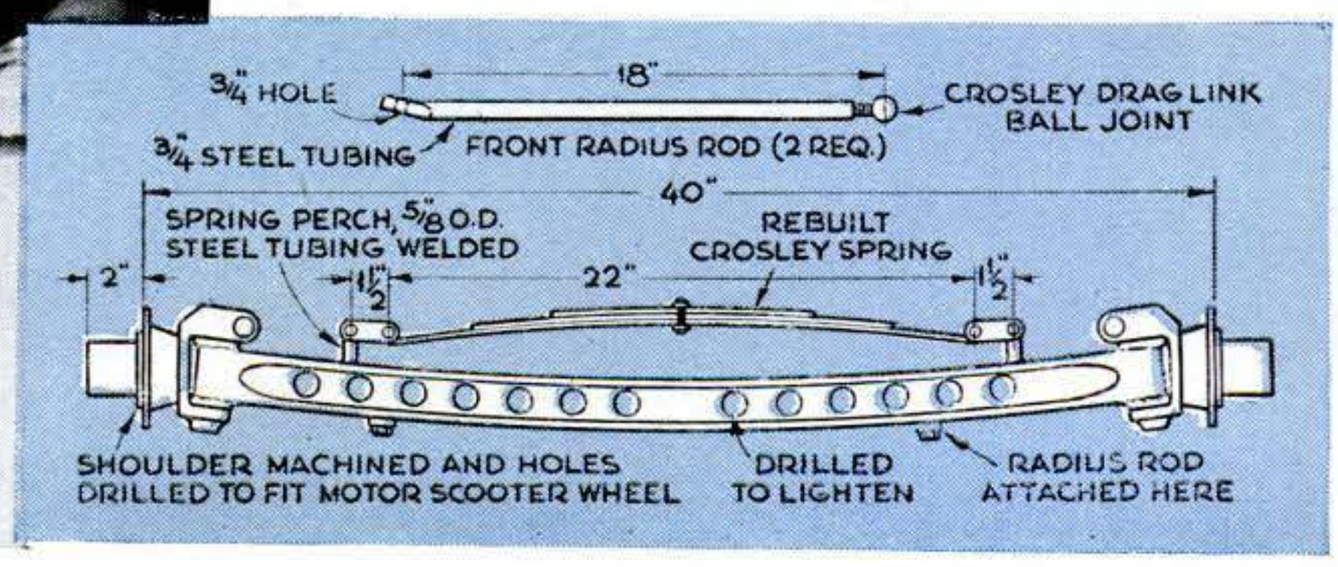
Our Dallas club got going a year ago. All last winter and through the spring, you could see the flare of welding torches and hear the rasp of hacksaws in scattered back yards all over town. Along with spring came a new crop of one-lung midgets, many of them with interesting modifications and improvements. I'll tell you about mine.

Before touching a single wrench, I sat down at the drawing board and did a little doodling. I wanted a car that could be built with a minimum of machine work and welding, one that would use mostly stock

Axle of Model-A front end was cut, shortened, welded in center, and planed to 1" thickness. Steering knuckles were cut down to U shape as shown, spindles shortened, and hubs modified to fit Cushman wheels. For both front and rear, Crosley springs were shortened to 22" o.c. and reverse eyes rolled in ends. Reverse eyes help to lower entire car. Radius rods were bolted to old spring-perch holes.







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parts. But I also wanted to maintain the beautiful proportions of an Indianapolis Special. It takes no more material to build a sleek car than a junky one.

First the engine. My racer is the only one in the Dallas club with the engine in front. I am convinced that's where it should be for the best weight balance, cooling, and the long look a racer ought to have.

Rules of the Dallas club allow a maximum displacement of 20 cu. in. for L-heads, 15 for overhead-valves, and 11 for two-cycles. The B.S.A. overhead-valve motorcycle engine that I chose hits the ceiling for its class.

In action, this has proved a good choice. In my first meet, the car turned in the fastest time trial of the evening—11 seconds for one lap of the 1/15-mile banked clay oval. Acceleration was terrific. And out on the open road I hit up to 60 m.p.h.

The engine then was still strictly stock, bought secondhand. I had been so busy completing the car that I had not had time to attempt any modifications on the engine.

Engines of this size (249 c.c.) are made by nearly all foreign motorcycle firms, and frequently can be bought used in this country at a reasonable price. With built-in transmission and clutch, they put you well ahead on the construction job.

In races, I start my engine by pushing, as is customary at most meets. But the kick starter could be used by extending its shaft so it will protrude beyond the frame.

The chassis design of my car would accommodate many other engines with a few minor changes. For easy removal, my engine is held in place by only two bolts. Both front and rear ends are also bolted in place. Many of the Dallas cars use steel tubing for frames. This keeps down the frame weight, but welding usually is required to attach a part.

The rear end is a big reason for the success of my car. Although simple in design, it is rugged and efficient. The solid rear axle is keyed to drive *both wheels,* in contrast to the one-wheel drive found in other midgets. This means there is no tendency to go into a spin when you gun it while broadsiding.

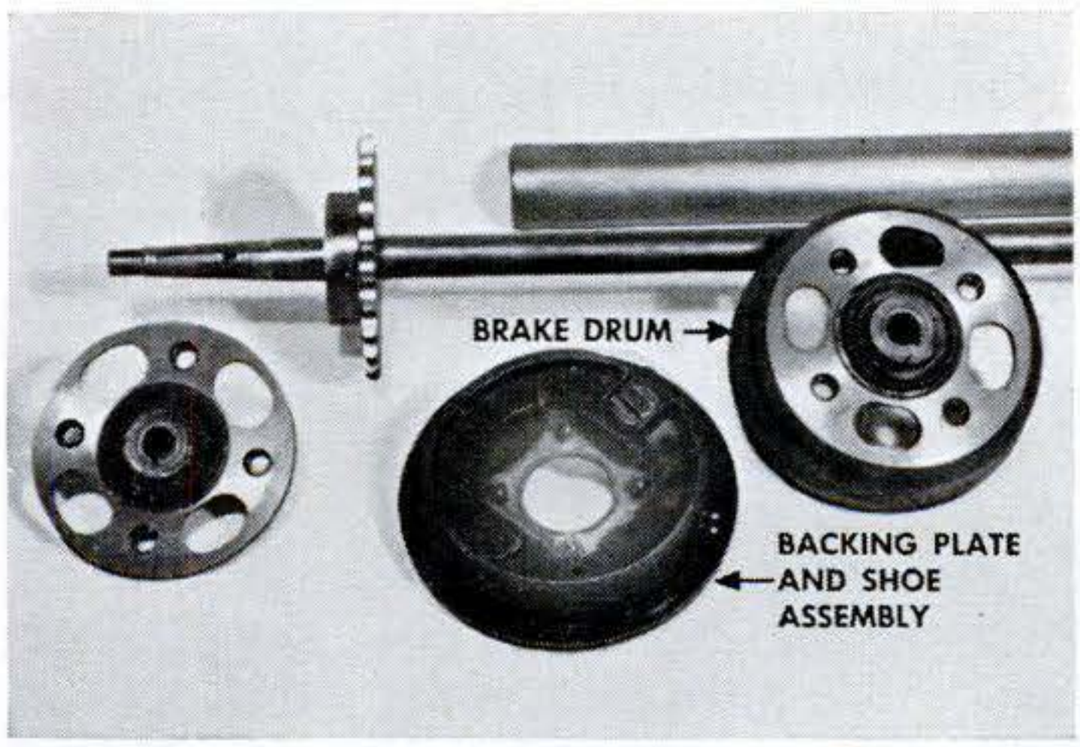
In competition, bumpers or nerfing bars are needed to protect the car. A safety belt is a must for the driver.

The Dallas club has worked into a very successful organization. Lights have been installed for night races. At the present time, meets are held twice monthly on Monday nights. Admission is free.

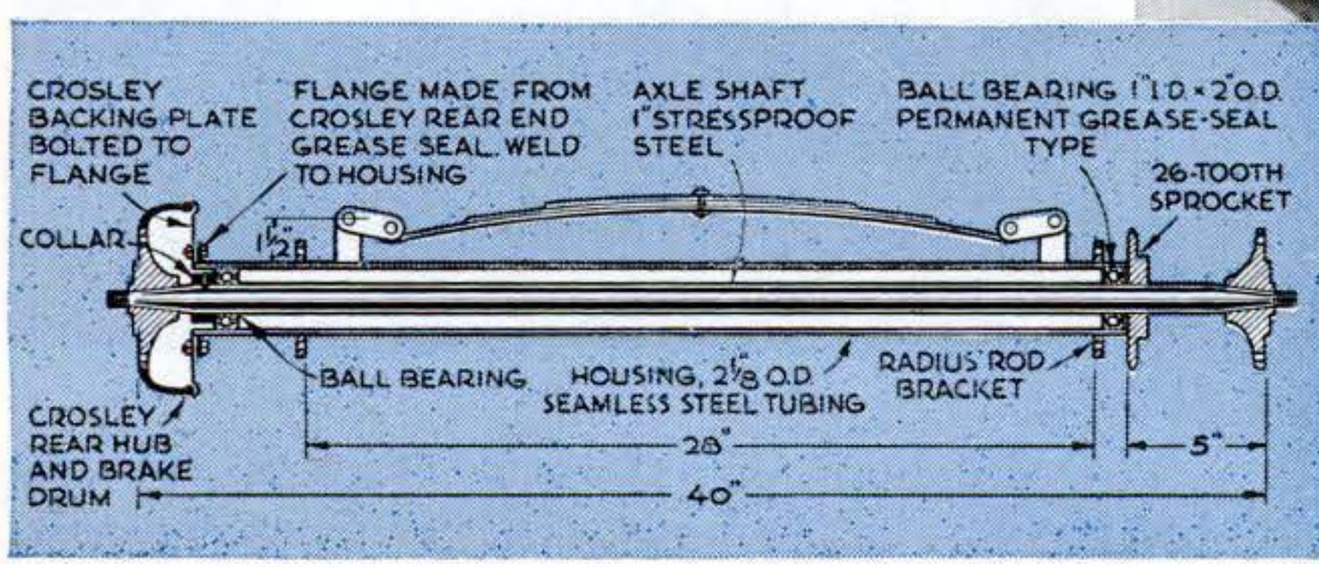
Other Texas cities have invited us to bring our cars and put on race programs under the sponsorship of such organizations as the Lions Club.

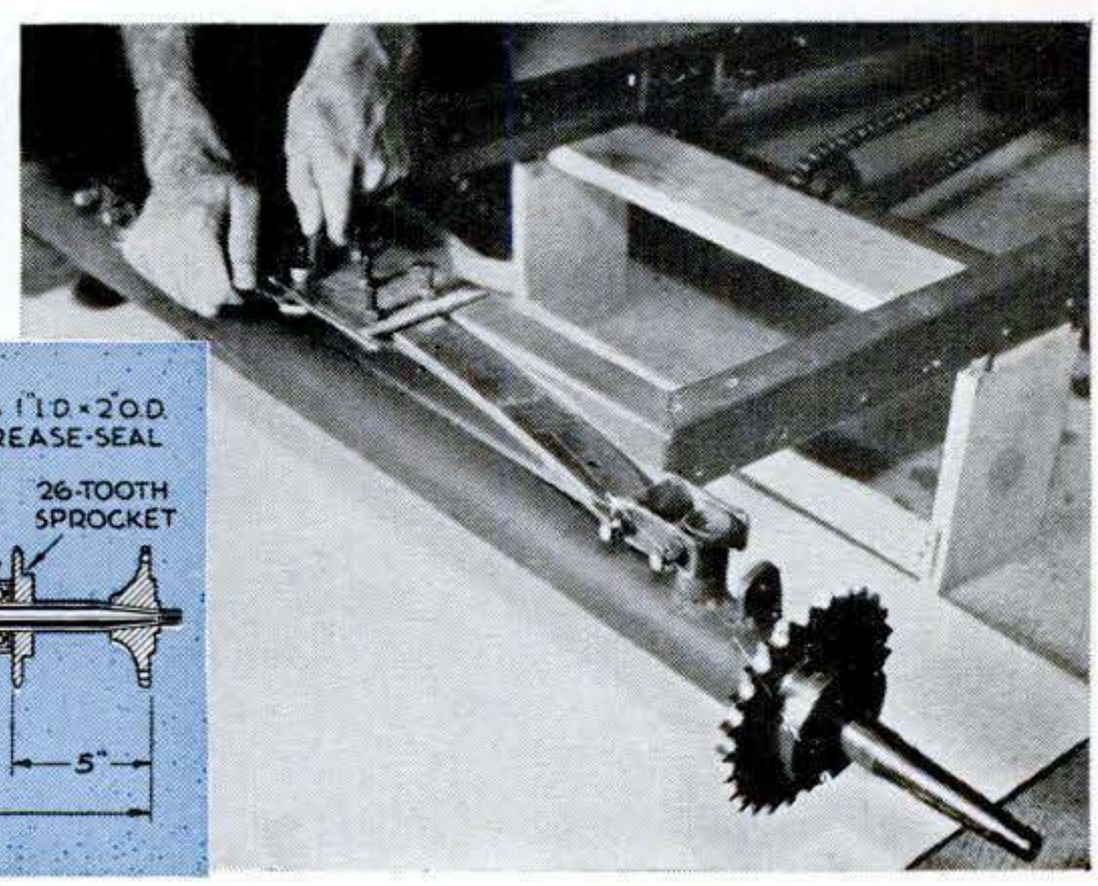
For us drivers it's all just sport. And, take it from me, you couldn't find a better one anywhere.

Two more pages of construction photos follow.



Solid rear axle drives both wheels. Axle, tapered to fit Crosley hubs, runs in ball bearings pressed into ends of .065"-wall tubing. Woodruff key and setscrews attach drive sprocket to right end of axle. Collar held by setscrew to brake end of axle prevents side play. Spring hangers are 1"-o.d. tubing welded to axle housing. Cushman 100 tires and wheels were used at rear, Cushman 4.00 by 8s at front.





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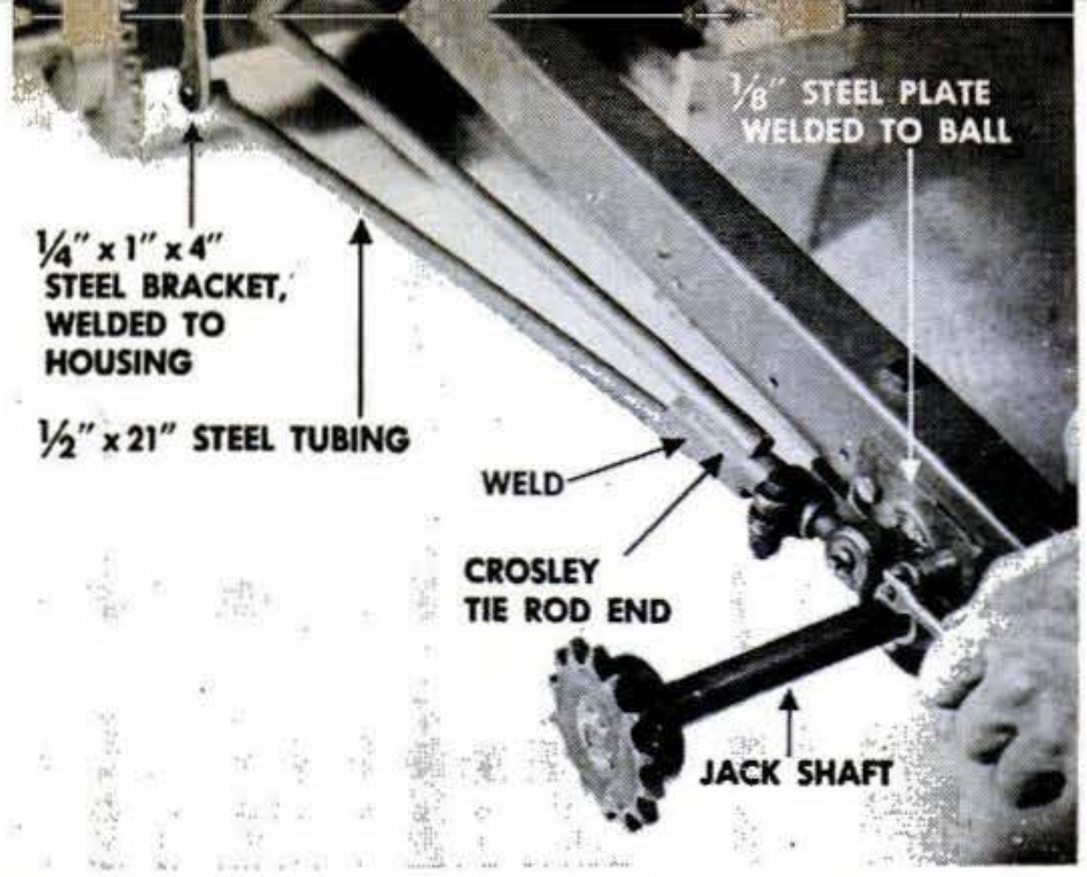
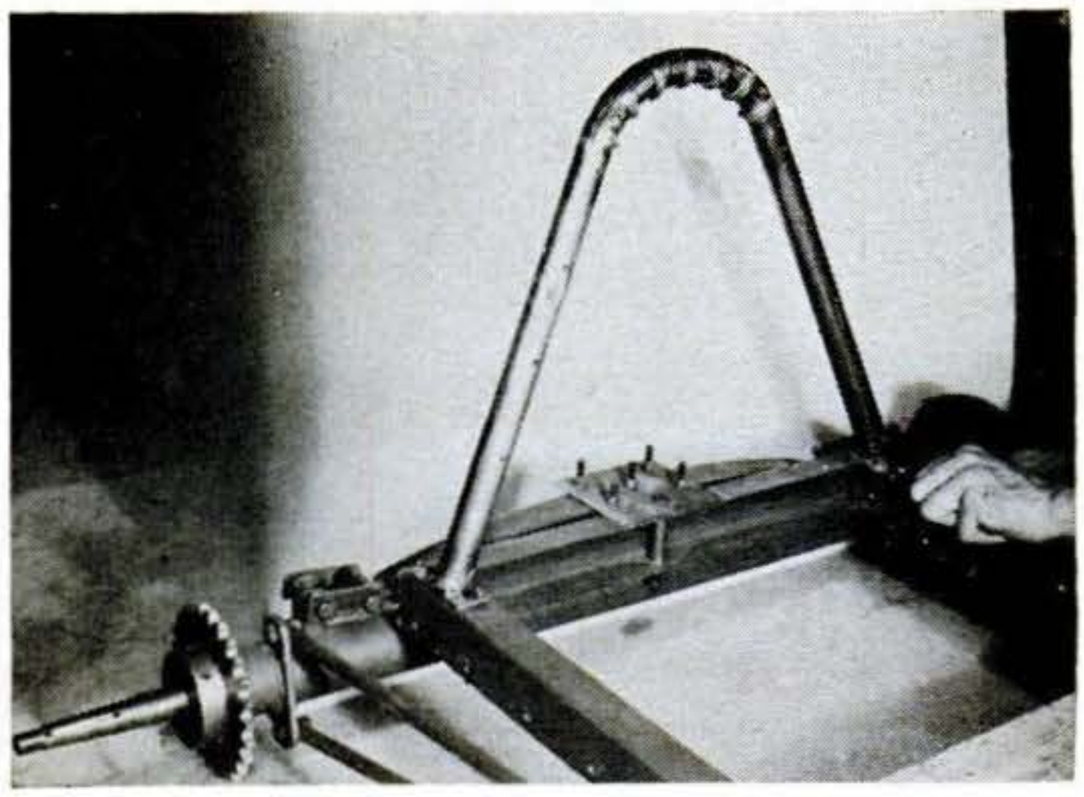
Jack shaft transfers drive from the center of frame to outside. The bearings have setscrews that lock shaft firmly to inner race. Woodruff keys and setscrews hold sprockets to shaft. Sprockets must be carefully aligned with those on engine and rear end. Gear ratios can be changed by changing sprockets.



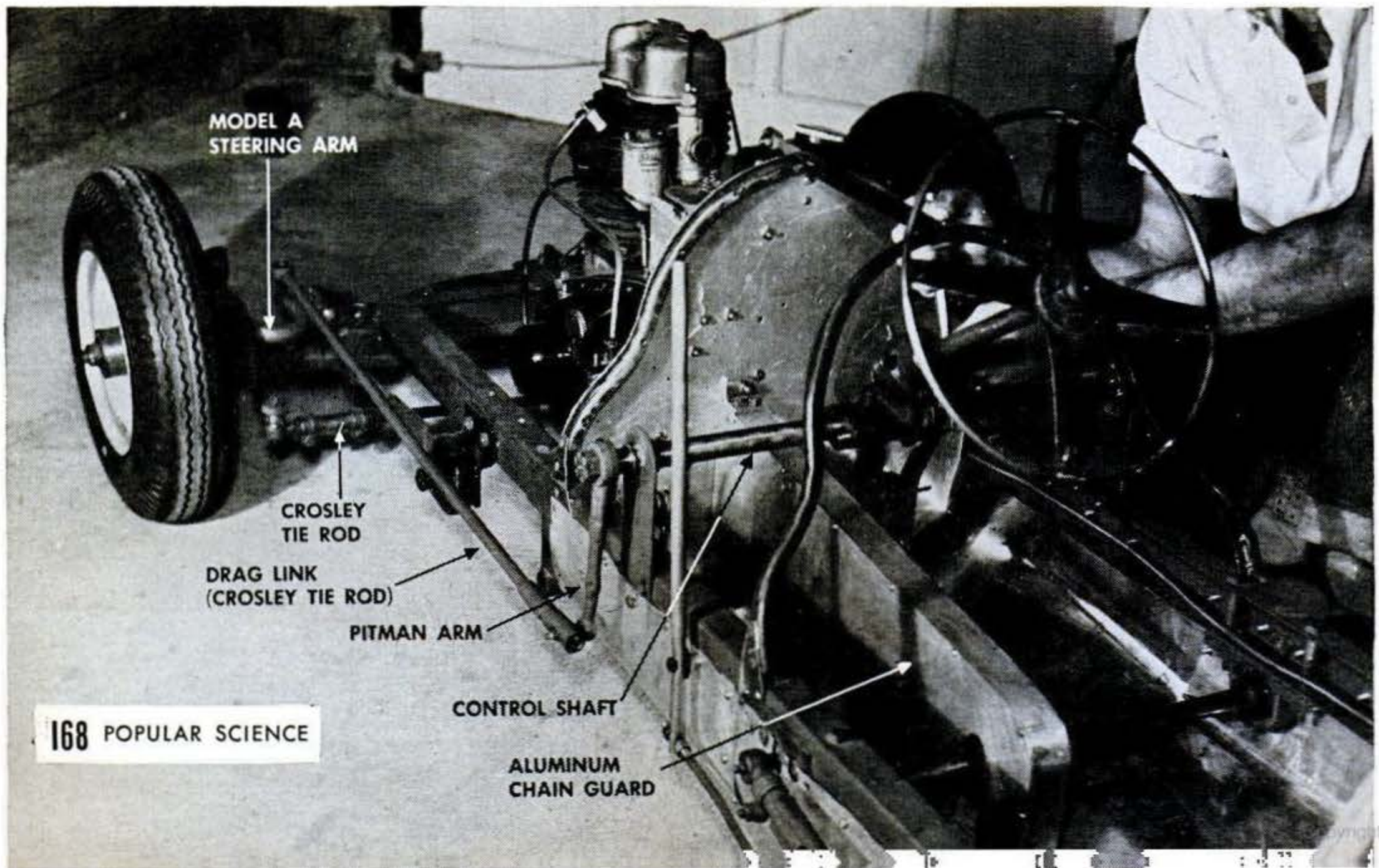
Rear radius rods were mounted on both sides like this. Front ends are above jack shaft.



Seat-back frame also serves as a roll-over bar. It was shaped from 1" thin-wall steel tubing, with steel plates welded to ends. Sheet aluminum was screwed to front of frame. Bottom pan also was formed of aluminum, screwed outside frame from seat back to firewall.

An aluminum firewall supports coil, oil tank, and battery box. Frame for firewall, hood, and cowl was shaped from cold-rolled channel that is used for installing metal lath in buildings. This bends easily without heating. The brake lever was pivoted to side of frame.

Crosley steering gear was center-mounted by lengthening control shaft and adding tubing extension on right side. Pitman arm was lengthened to 6½" o.c. and left steering arm shortened so less than three-quarters of a turn of steering wheel moves front wheels from full cramp to full cramp position. This fast steering is needed for racing. Clutch and gas pedals are on opposite sides of the chain guard. The guard was shaped from sheet aluminum.



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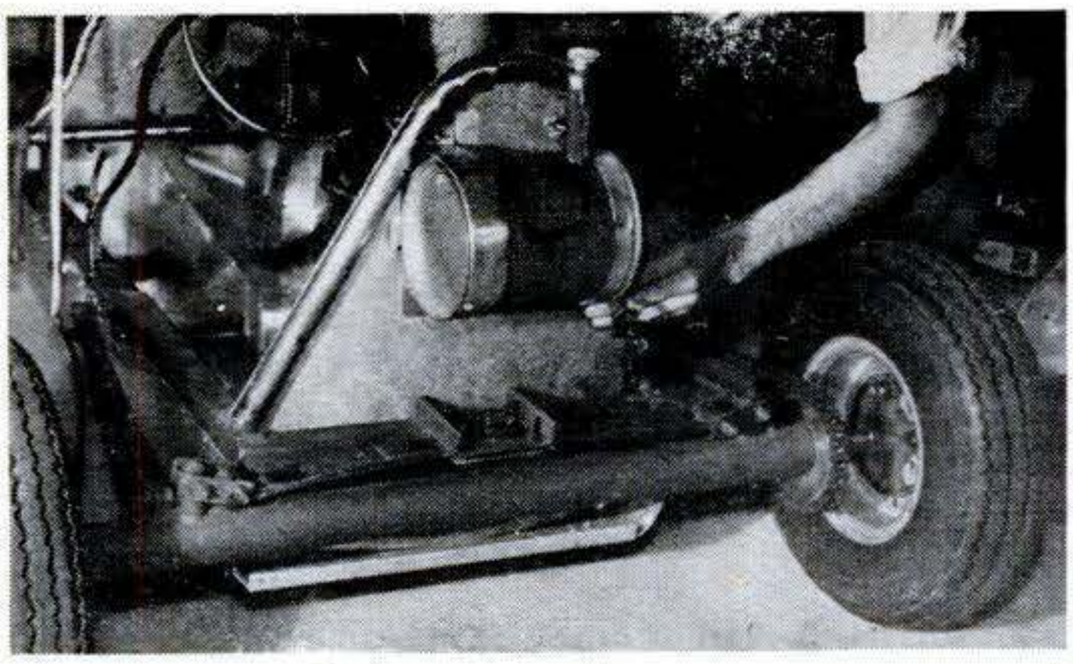
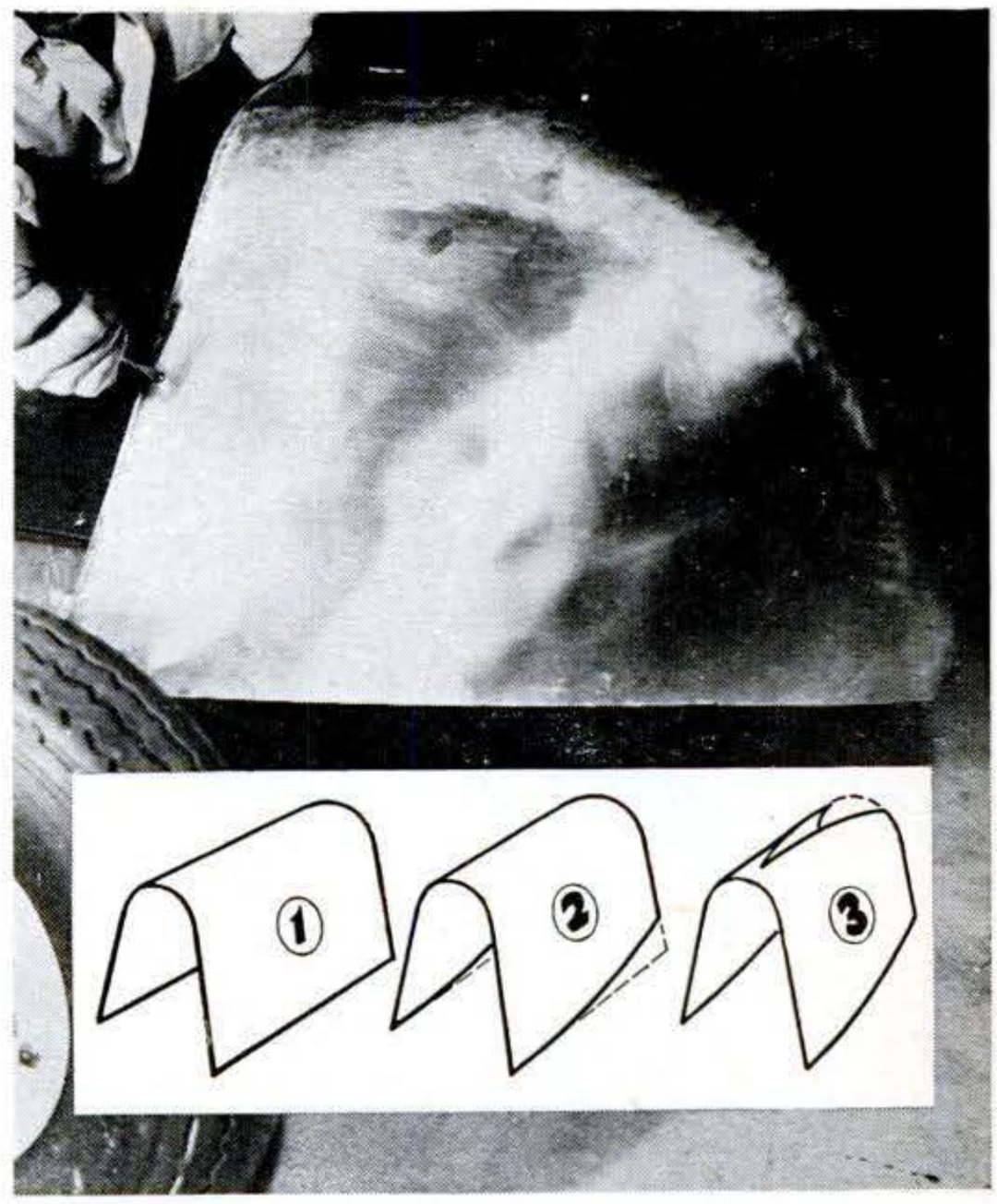
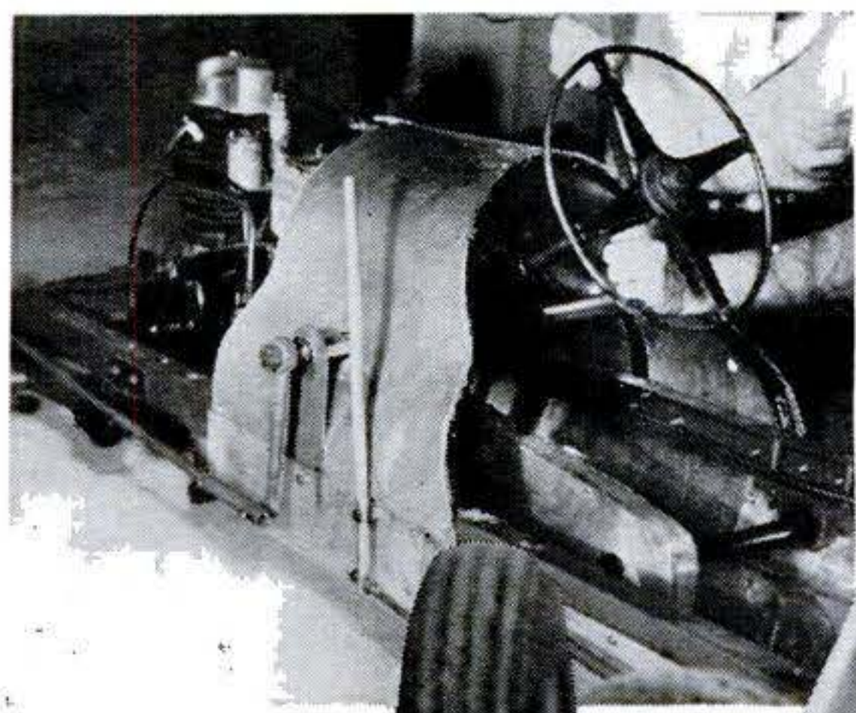


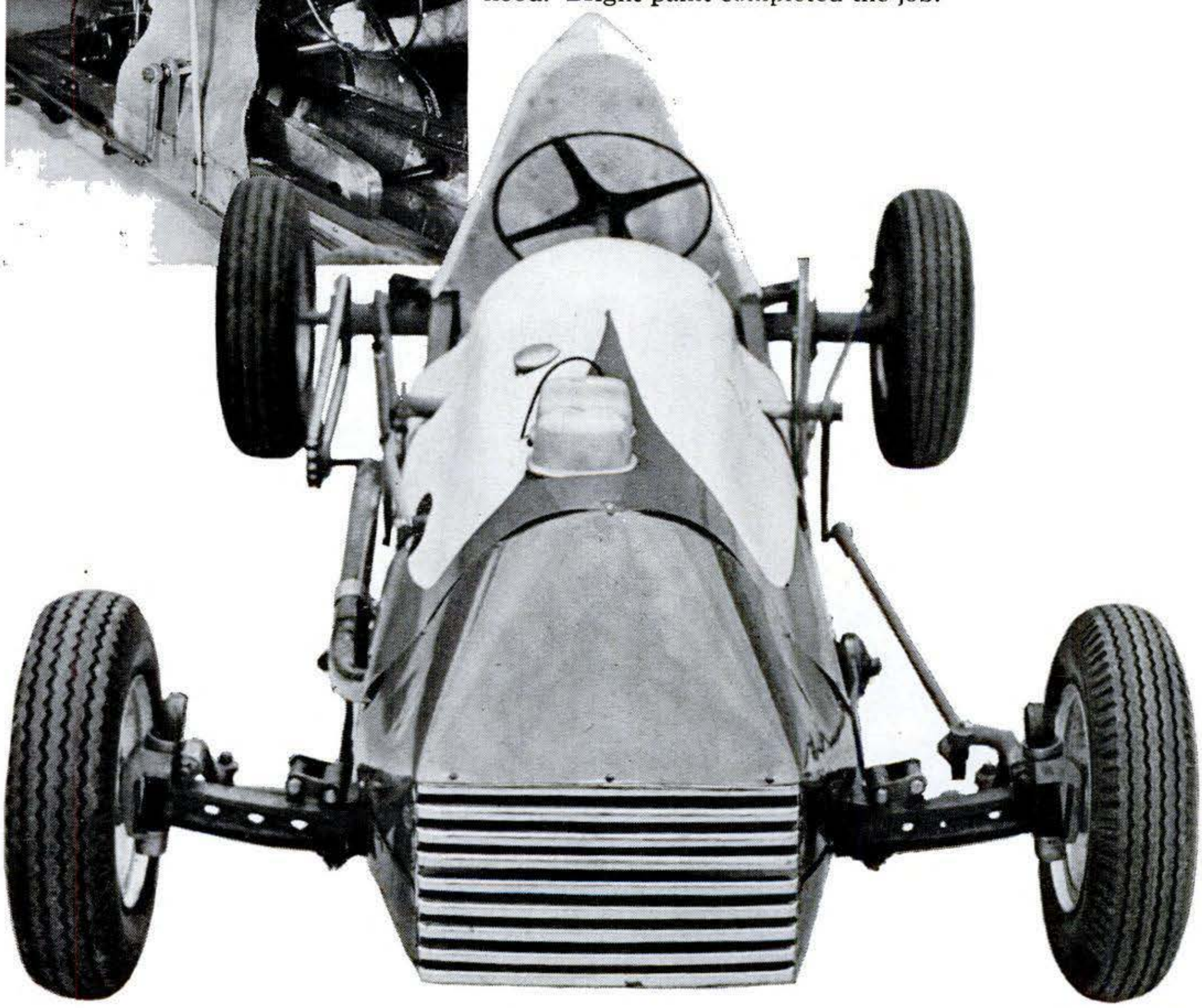
Gas tank made from a gallon can was strapped high on back of seat for gravity flow. Filler pipe extends above tail section of the body.



Tail section was made from one sheet of aluminum, attached to seat frame with 8-32 machine screws (1). Then it was cut to a curve along bottom edge (2), and cut out at top rear (3). Rear section was shaped with hammer and dolly and welded along seam. Weld bead was smoothed with file and emery cloth.



Rest of body consists of simple curves. All pieces were attached with machine screws, and the edges smoothed with a file. Radiator shell was shaped to suit grille used. Cooling louvers are needed in radiator shell and top of hood. Bright paint completed the job.



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How to Sharpen a Saw

You'll do better work and save time by keeping your saws in first-class shape. ***By Edwin M. Love***

YOU don't have to be a pro to do a good job at sharpening handsaws. Contrary to old-fashioned opinion, it isn't a mysterious rite, to be undertaken by experts only. Actually, keeping your saws in perfect cutting condition is a skill you can pick up with a bit of practice. One good way to begin is to touch up your saws as they first begin to lose their sharpness. After you've done this a few times, you'll be better fitted to resharpen a badly blunted saw.

The tools you need won't make much of a dent in your shop budget. They include:

Vise. A special saw vise is a help if you are going to do much sharpening, but a pair of 1″ by 6″ boards in your bench vise

Mounting the saw. Most saw vises can be clamped to a stand, sawhorse, or bench. Be sure to set up the clamp where the light is good so you can see clearly the edges and points of the teeth. If your saw needs sharpening only occasionally, you don't need to buy a saw vise. Use your bench vise and clamp the saw between two 1″ by 6″ boards. Let the teeth project above the saw vise or boards as necessary for filing or setting them.

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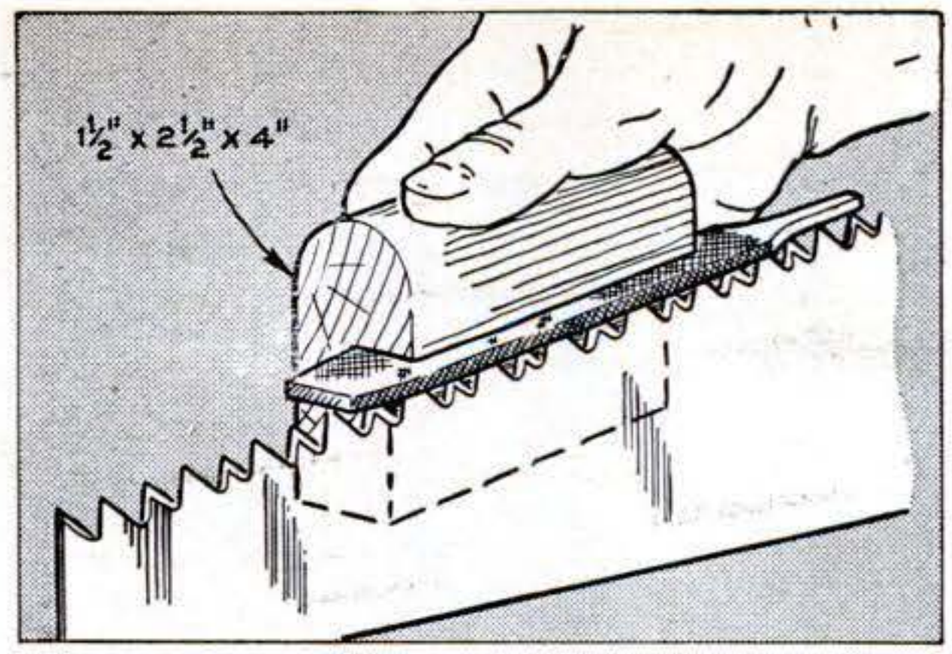
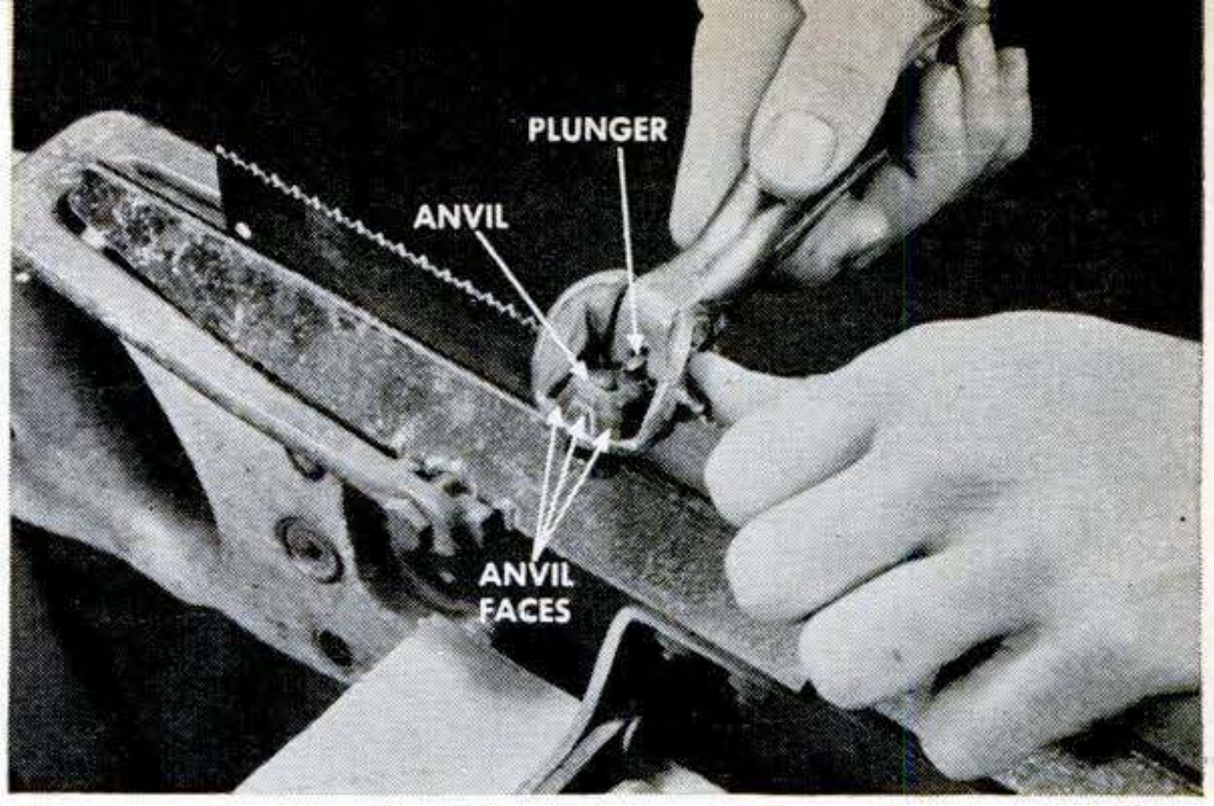


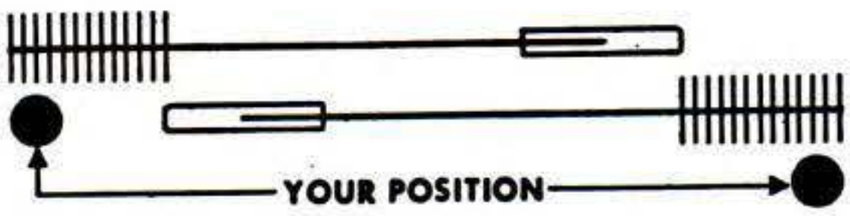
Jointing the teeth. If teeth are worn down unevenly, they must be aligned. You can buy a saw jointer or you can make one as shown above. A jointer is simply a holder for a second-cut mill file. Pass jointer over teeth until you see a bright spot on point of each tooth.



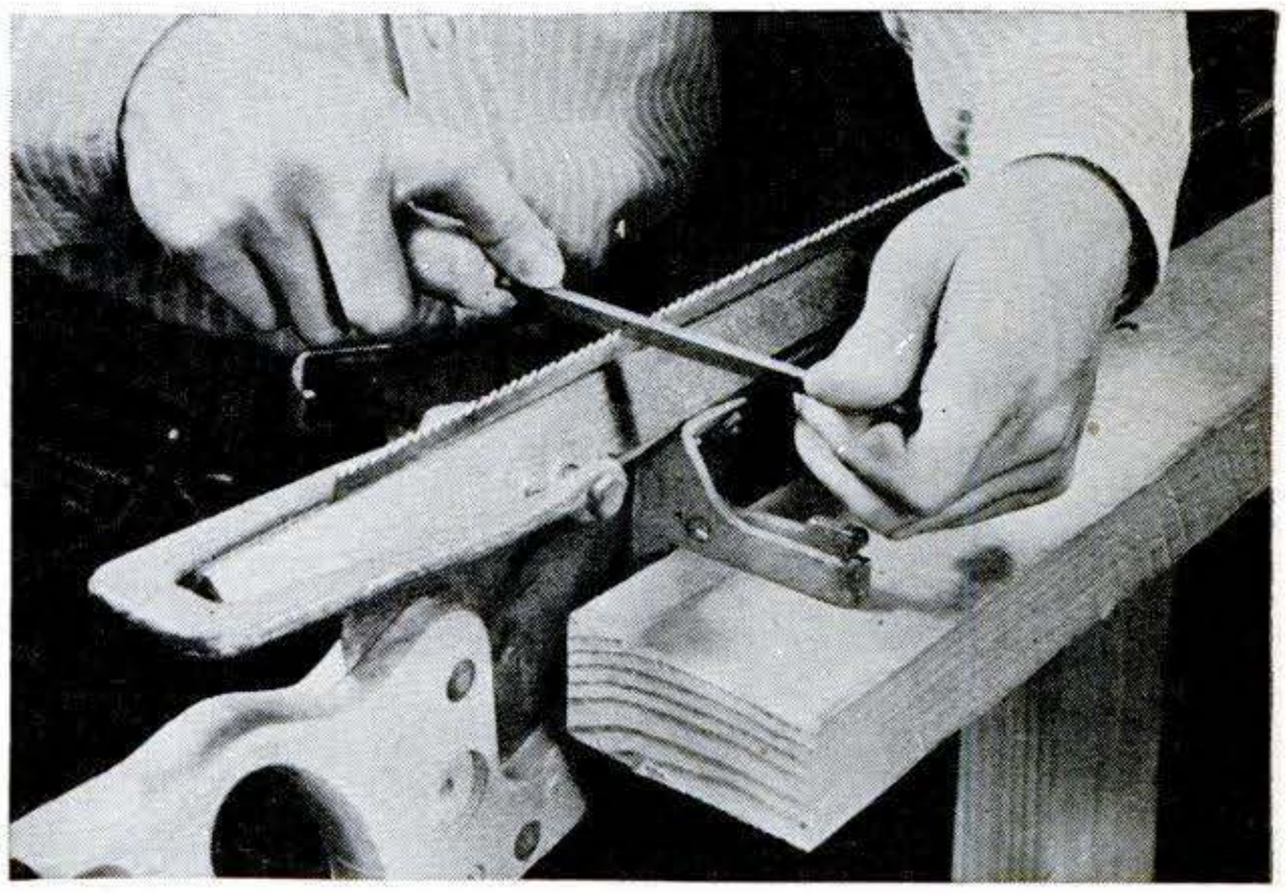
Setting the teeth. Turn the anvil so the proper face is toward the plunger. Begin at one end of the blade with the first tooth that is bent away from you. Slip the saw set over the tooth and squeeze the handles. Exert only enough pressure to set the tooth without crushing it. Set every other tooth. Then turn the blade around and set the other teeth.

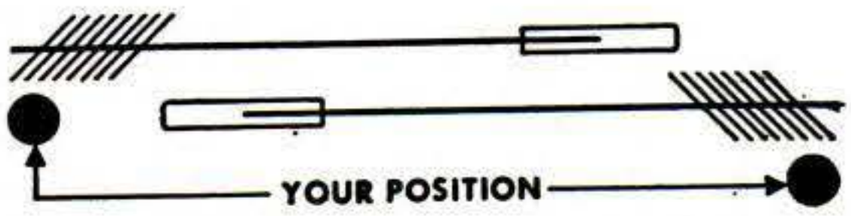
is all right for occasional jobs. It is important, though, to have some way to clamp the blade fairly close to the teeth to keep it from chattering under the file. Combination vises and file-guiding jigs are available and are especially useful if you are a novice at sharpening, or if a saw is in bad condition.

Saw jointer. Like a saw vise, a saw jointer can be bought at a hardware store, but you can make one in a few minutes (see drawing above). This homemade jointer is nothing but a rabbeted block of wood with a slot to hold a mill file that evens the height of the teeth. ***[Continued on next page]***

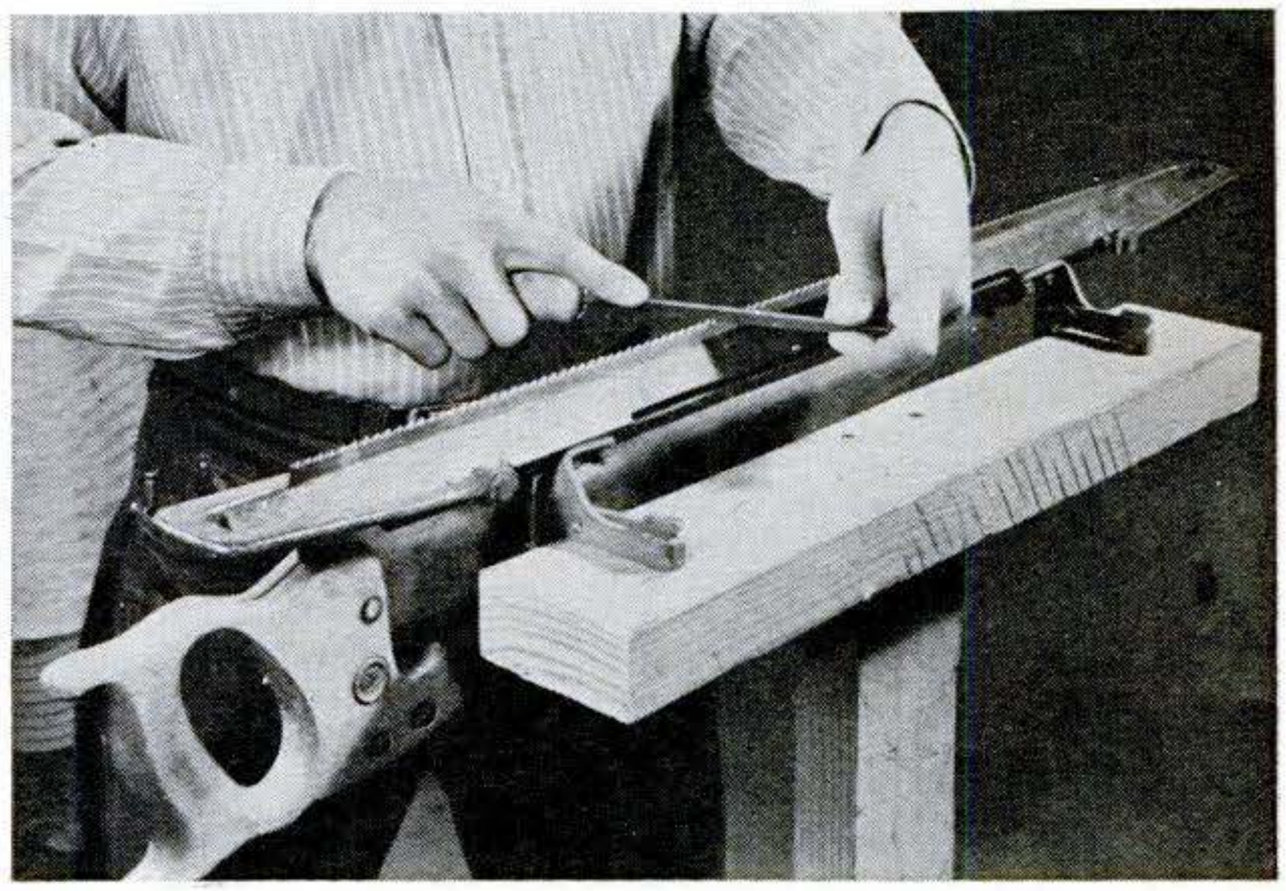


Sharpening a ripsaw. Begin at the point and work toward the handle. Put the file in the gullet between a tooth set away from you on the right and the tooth set toward you on the left. Hold the file level and at 90° to the blade. File only on the push stroke. File only enough to narrow the tip of the jointed tooth by half. Filing in the next gullet will complete pointing the tooth. File in every other gullet. Reverse the saw and file in the remaining gullets.





Sharpening a crosscut saw. Begin at the point and work toward the handle. File in every other gullet against the face of the tooth. Reverse the saw and file the remaining teeth. Hold the file level and at about 45° to the blade, instead of at 90° as you do when sharpening a ripsaw.



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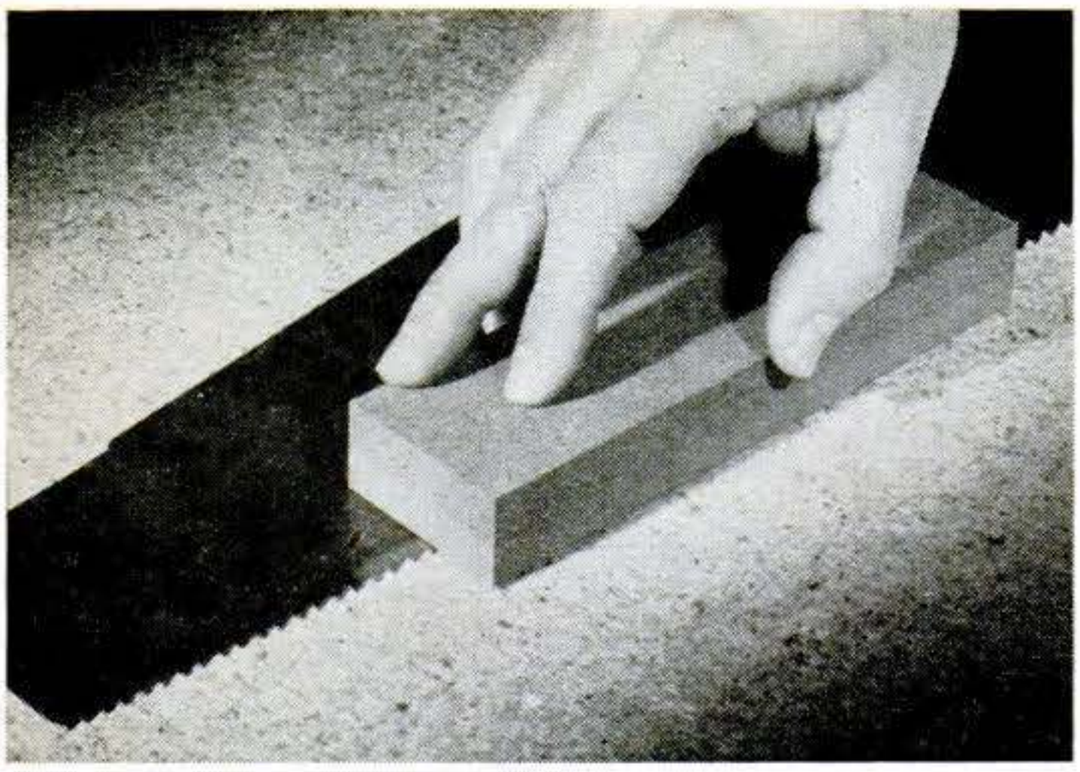


Dressing the teeth. After you have sharpened all the teeth, lay the saw on a bench or board so the blade is flat. Slide a file or oilstone gently over the sides of the teeth. This will remove wire edges or burrs left by filing.

Saw set. This is a tool that bends saw teeth left or right so they will cut a kerf slightly wider than the blade thickness, giving working clearance for the blade. Numbers on the anvil faces correspond to the number of points (teeth) to the inch of different saws. Before you use the tool, turn the proper face toward the plunger. For example, if yours is an 8-point saw, turn face No. 8 toward the plunger.

When the handles are squeezed, the plunger bends the tooth against the beveled face. A stop automatically fixes the depth of the bend to about one half the tooth height. When you're setting teeth, remember to set them in the direction that they were set originally. You may break a tooth if you set it in the opposite direction.

Files. Besides the second-cut mill file for jointing the teeth, you'll need several triangular files for sharpening. They can be a handsaw blunt file, a slim taper file, or an extra-slim taper file. The kind and size depend on the size of the saw teeth. For instance, a good file for a 5½- or 6-point saw is an extra-slim taper file 7″ long. For a 17-point dovetail saw, you'd want a 4″ extra-slim taper file.

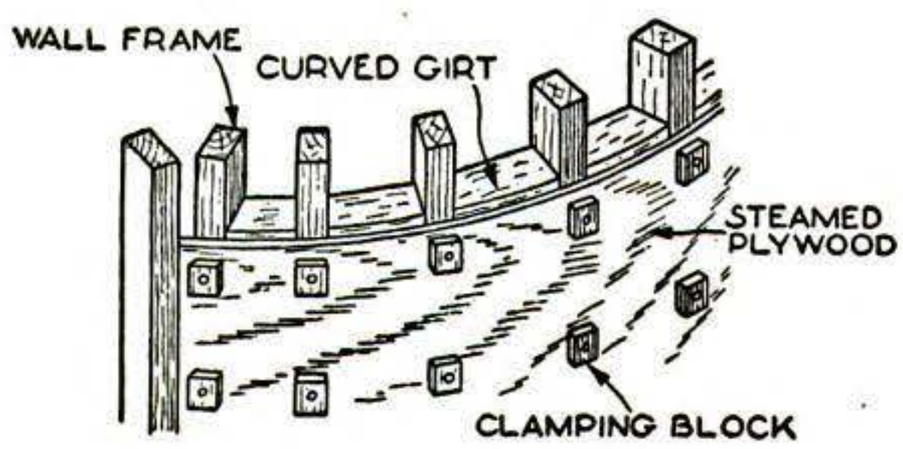
Pick a saw file that has a cross section at least twice the depth of the saw tooth. And use as long a file as possible. Then you'll be able to make steadier, more effective strokes.

Sharpening hints. When you are filing the teeth, try to retain their original shape. And file all the gullets the same depth.

Your saw won't need setting every time you sharpen it, but it is a good idea to joint it lightly before each sharpening. It does need setting when it drags and binds—then the teeth aren't cutting a wide enough kerf to give the blade clearance.

Dull coping-saw blades can be sharpened and new ones improved by filing. With the blade in the frame, lock the frame in a vise. Use a very small, fine file. Steady the blade near the point of filing with your thumb and forefinger. All teeth can be filed from one side if you will change the angle and cant of the file from right to left according to the set of the tooth. END

CURVED PLYWOOD WALLS



If the curve of a wall is not too great, plywood can be applied directly to the frame by nailing or nailing and gluing. The smoothness of the curve depends on the framing. When studs are too far apart, flat areas will appear between them. This can be remedied by inserting horizontal curved girts or by adding more studs.

Steaming or soaking (suitable only for waterproof plywood) permits bends of fairly small radius. A panel that is to be glued to a frame must be bent and dried on a form.

The wall framing itself can be used as a form, as shown in the sketch, if the wet sheet is clamped to it or held by nails driven through wood blocks. When the panel is dry, split the blocks to expose the nail heads and draw them. The shaped piece can then be glued in place.

Often it is simpler to use two or more thin sheets of plywood on a sharp curve than to steam a thicker sheet.

The following are the smallest radiuses to which Douglas fir plywood can be bent:

Thickness	Lengthwise (across outer grain)	Crosswise (with outer grain)
¼″	24″	15″
⅜″	54″	36″
½″	8′	6′
⅝″	10′	8′
¾″	12′	10′

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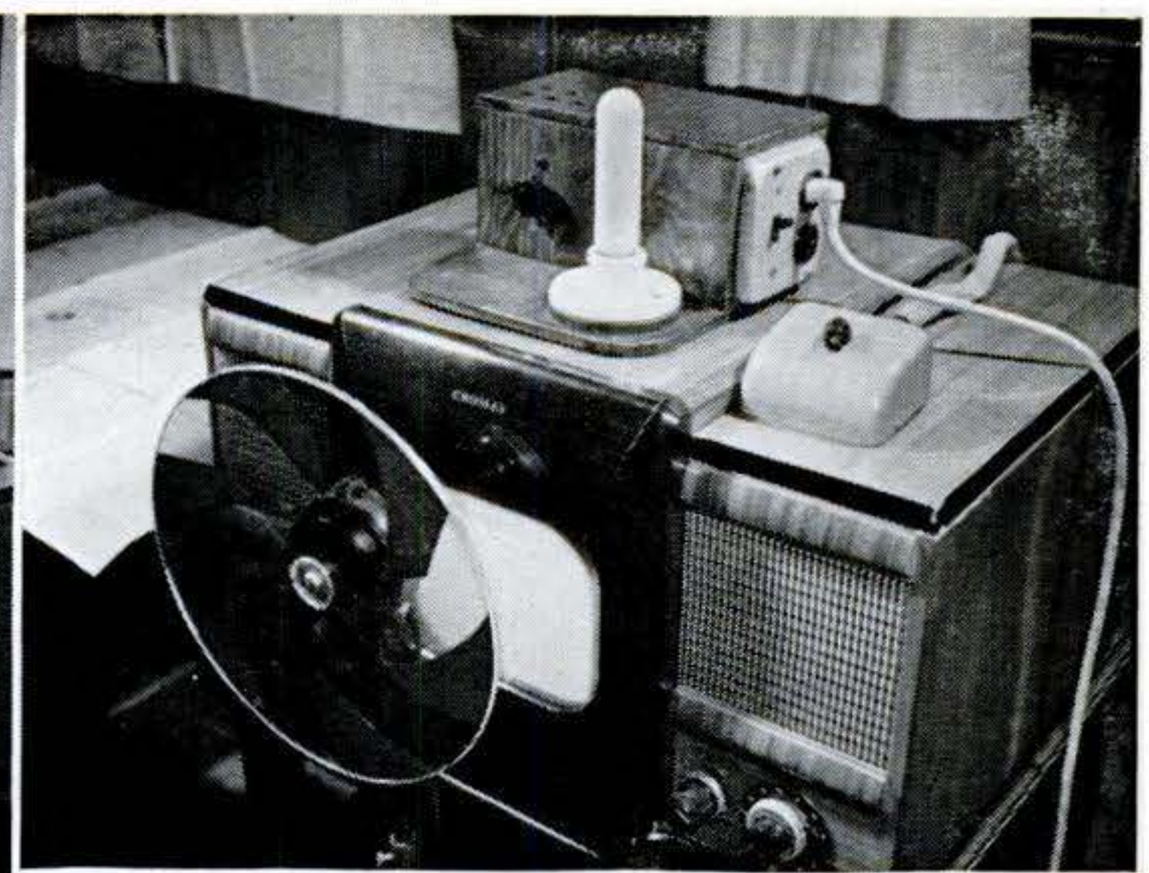
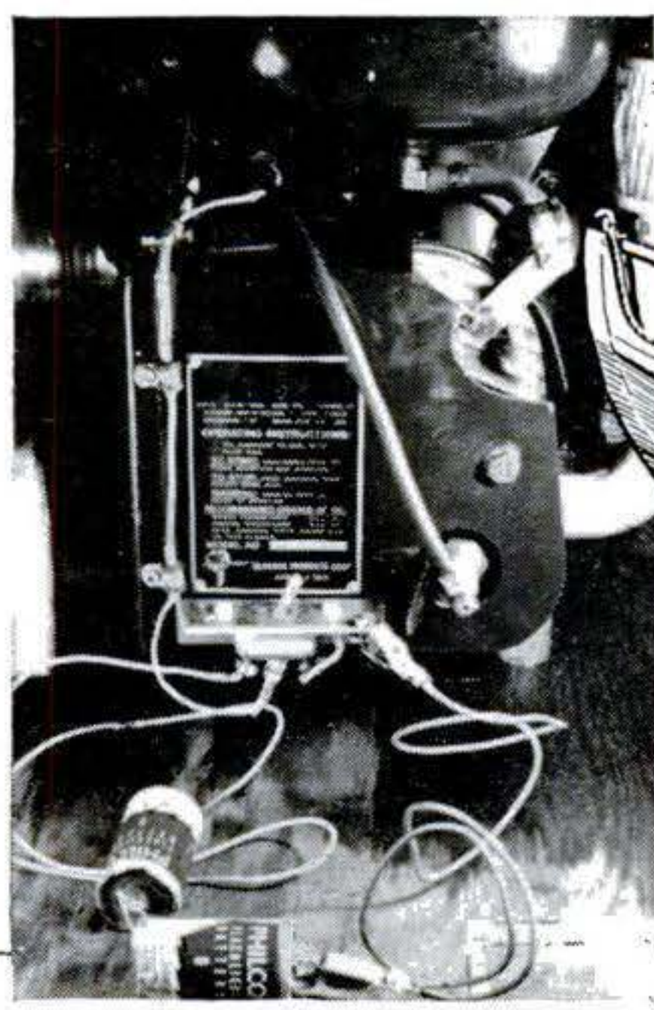
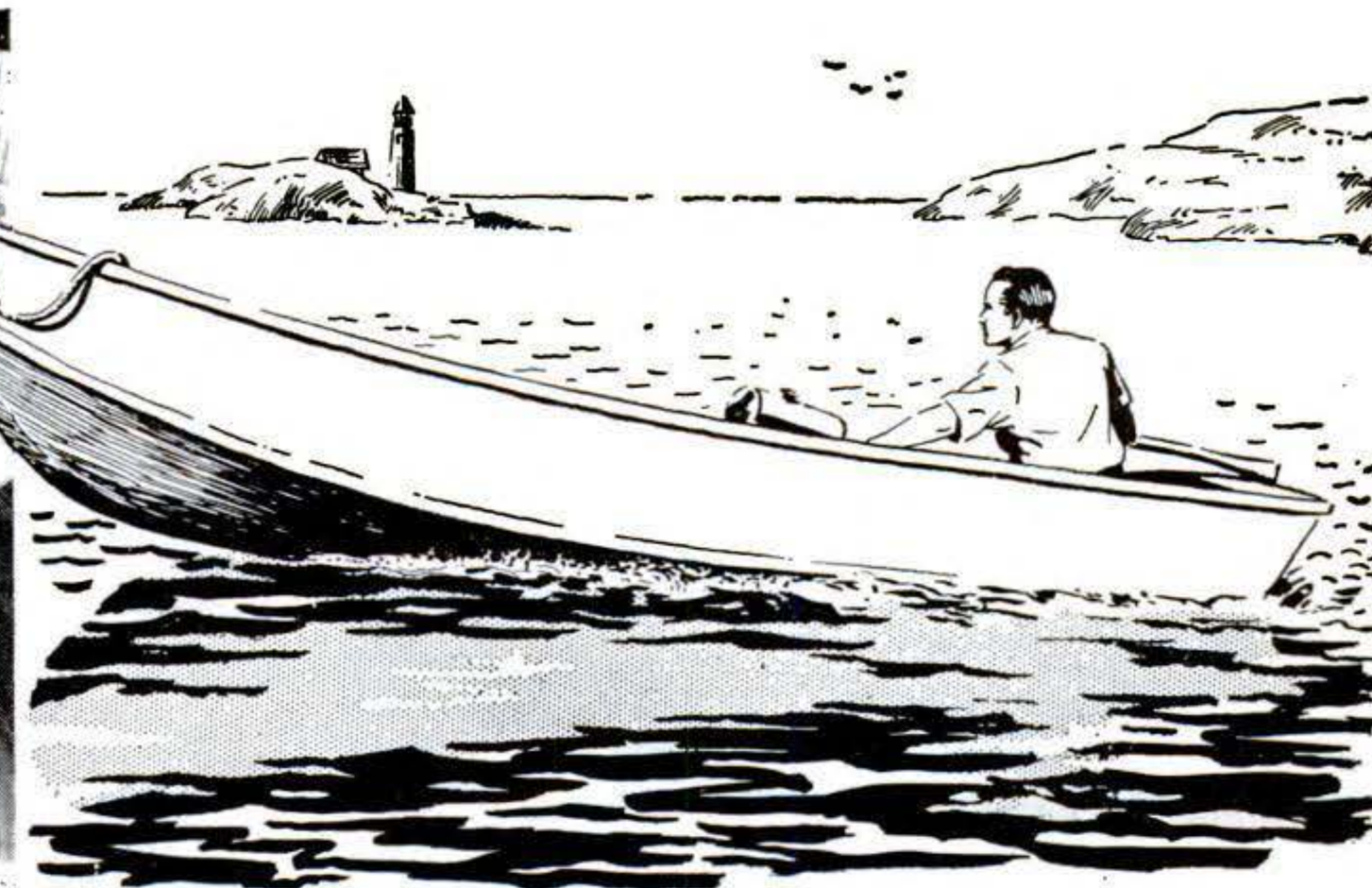


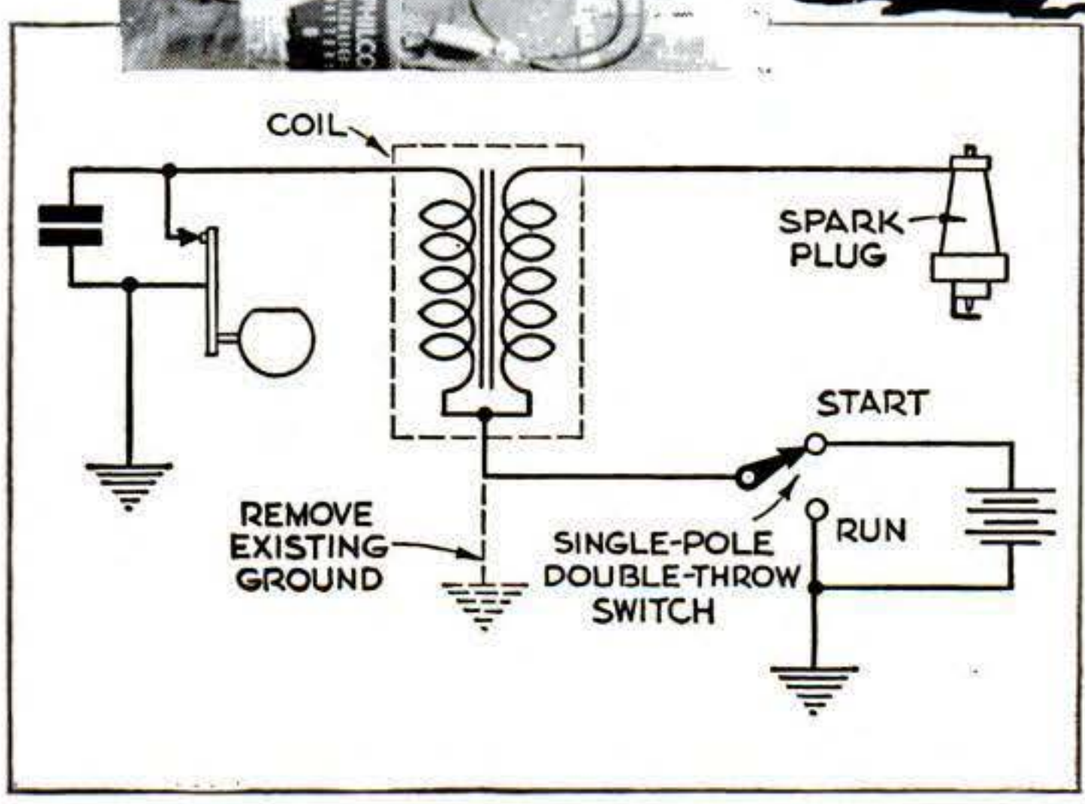
Robert Peters, left, adjusts speed-controlling rheostat while Carl Weiner holds his finger on the color disk to synchronize it with the picture. Adapter is box at top right of cabinet.

Homemade Color Wheel Gives High-School Boys Color TV

COLOR television is an old story to two New Jersey high-school lads. Robert Peters, 14, and Carl Weiner, 16, have been watching colorcasts for a year and a half. To get their first glimpse of CBS' broadcasts, they readjusted the built-in controls in a 630-type receiver manufactured by Crosley. Later they purchased and installed a commercial adapter and improvised a color wheel from bits of plastic, colored cellophane, and an induction motor borrowed from a fan. To control the speed of the motor, they wired it in series with a rheostat and light bulb.







Spark Booster Starts Engine Faster

A SMALL engine with a flywheel magneto will often start faster if you add a booster battery to fatten up the spark. Two flashlight cells in series with the primary magneto winding make my engine kick off very easily. I removed the flywheel to get at the coil, disconnected the coil ground, and ran out a lead as shown in the diagram. I use the rig only for starting, switching it over as soon as the engine catches. Only two or three volts should be applied to the winding. *—John H. Milbourn, Seattle, Wash.*

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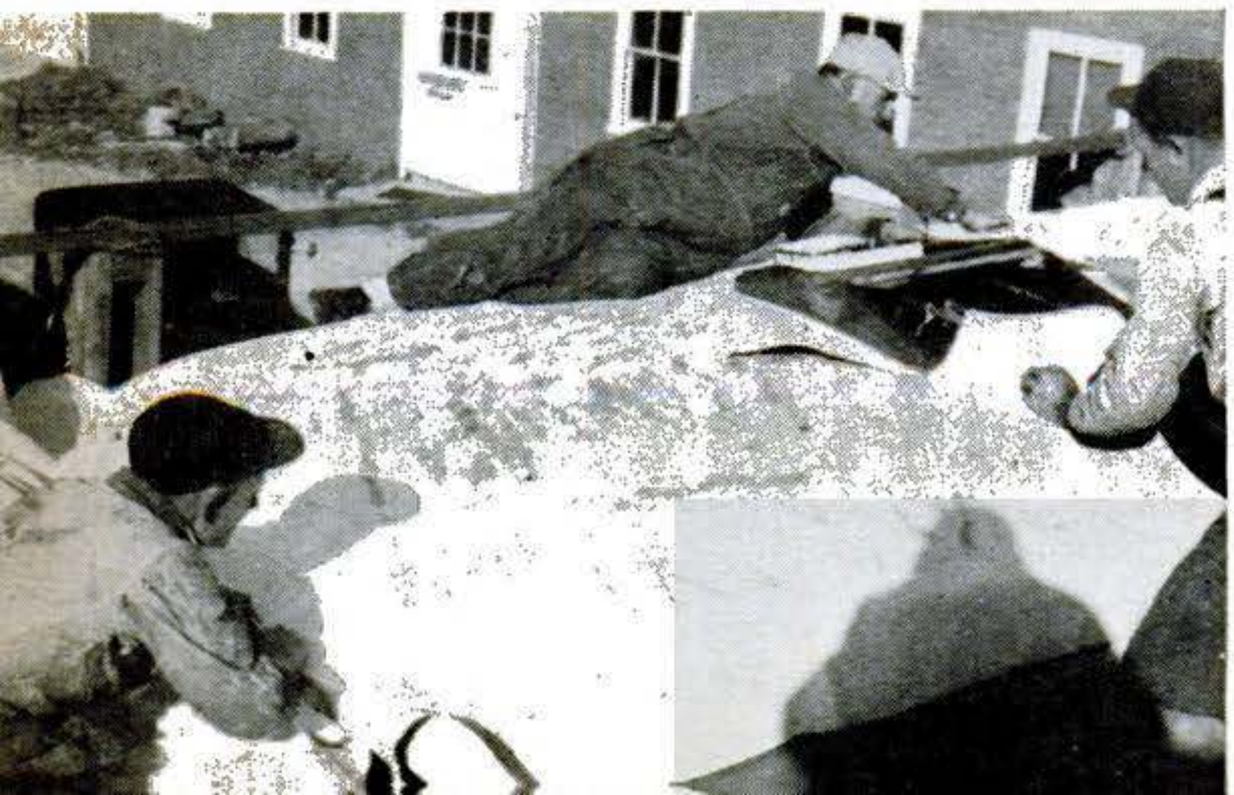
Whether your boat is old or new, canvas properly laid will make the cabin roof or deck watertight.

How to Canvas a Boat Deck

By Elon Jessup

Spreading new canvas over a cabin roof. Dark spots on canvas are fresh paint seeping through. An opening, upper right, has been cut in the canvas to make room for the skylight.



CONSIDERING the beating that decks of small craft take from the weather, it's not surprising that they develop irritating leaks. About the best and easiest way to get a tight deck or cabin roof is to cover it with canvas and then paint the canvas.

To cover the deck of a small boat, 10-oz. canvas usually is used. Some larger craft take 12-oz. material, but 10-oz. is more common. Such canvas runs up to 10′ in width.

The canvas must be cut to fit around some things—skylights, bitts, and hatchways. But take up everything on the deck or cabin roof that you can—coamings, moldings, and accessories such as a searchlight or horn—before you apply canvas. Then you won't have to cut it so much.

Make sure the planking is dry, clean, and smooth. Sand or plane off any ridges and fill holes with white-lead putty. Then when you're ready to lay canvas, give the planking a heavy coat of paint and put the canvas right down over the fresh paint. Final step is to paint the canvas itself.

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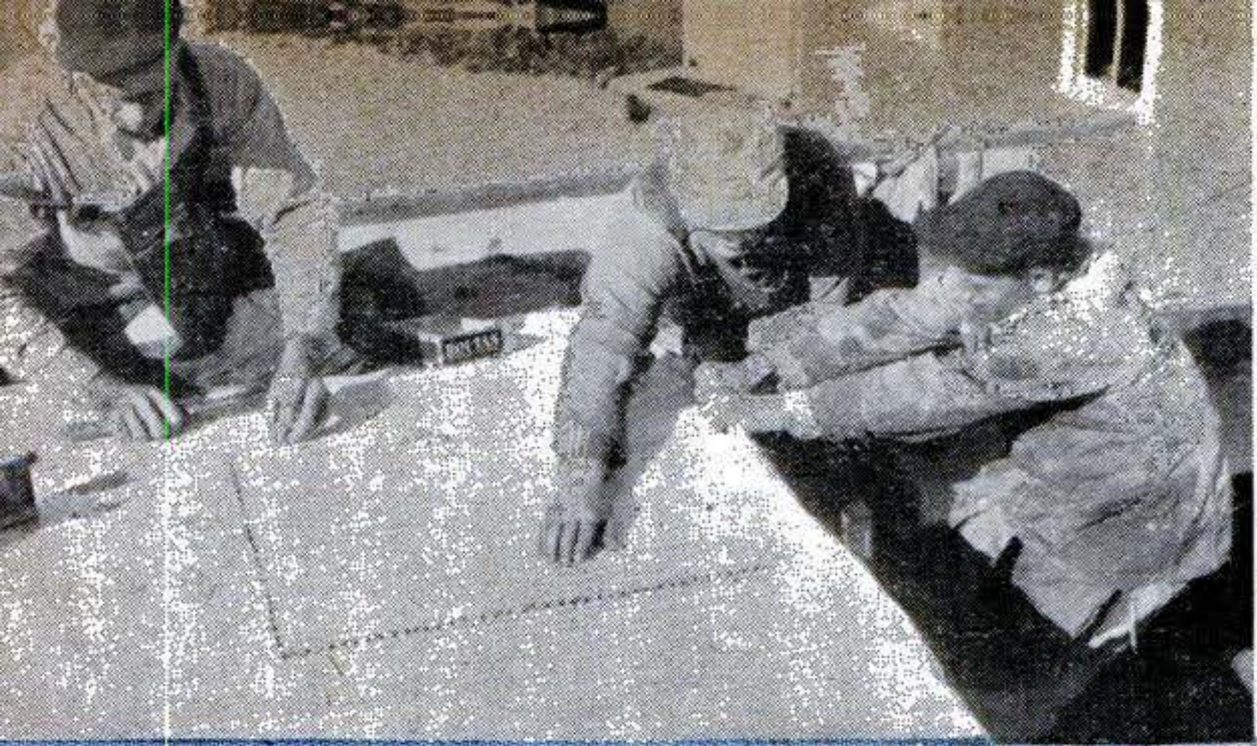
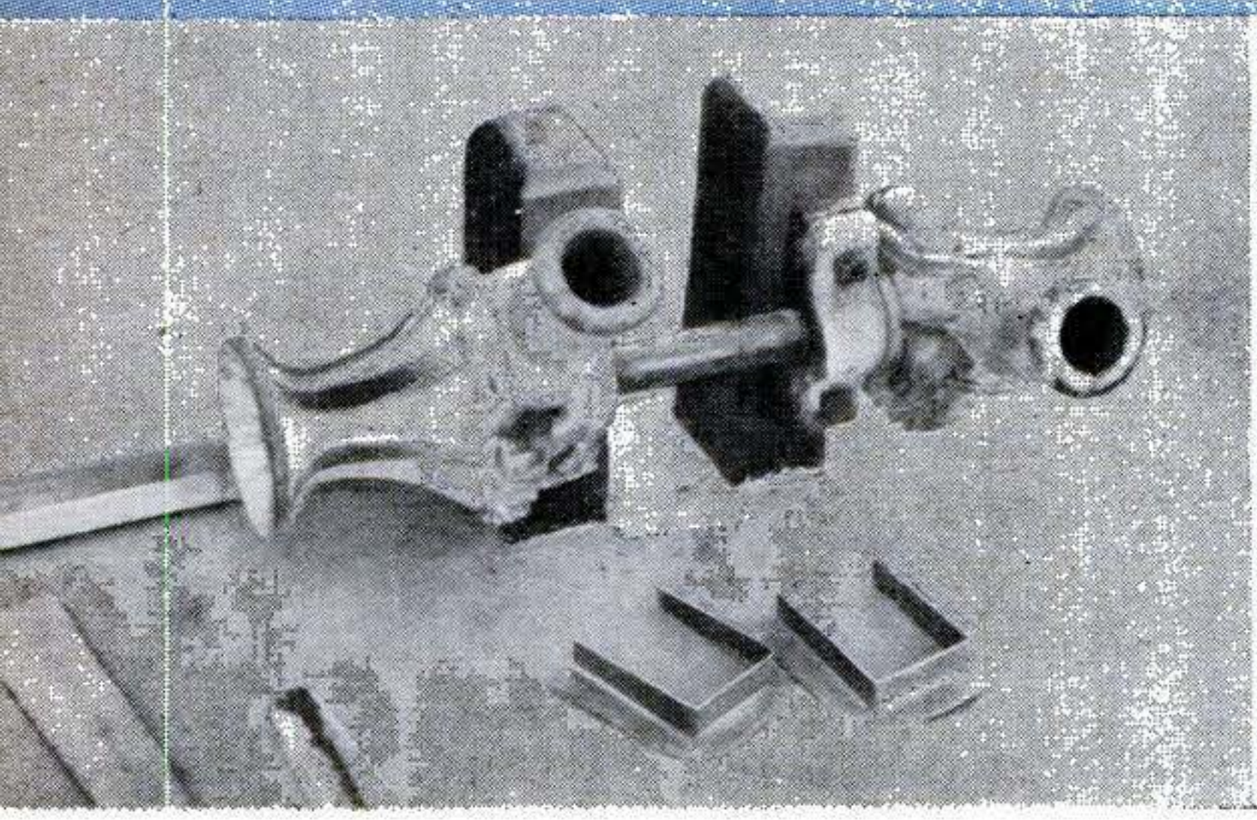


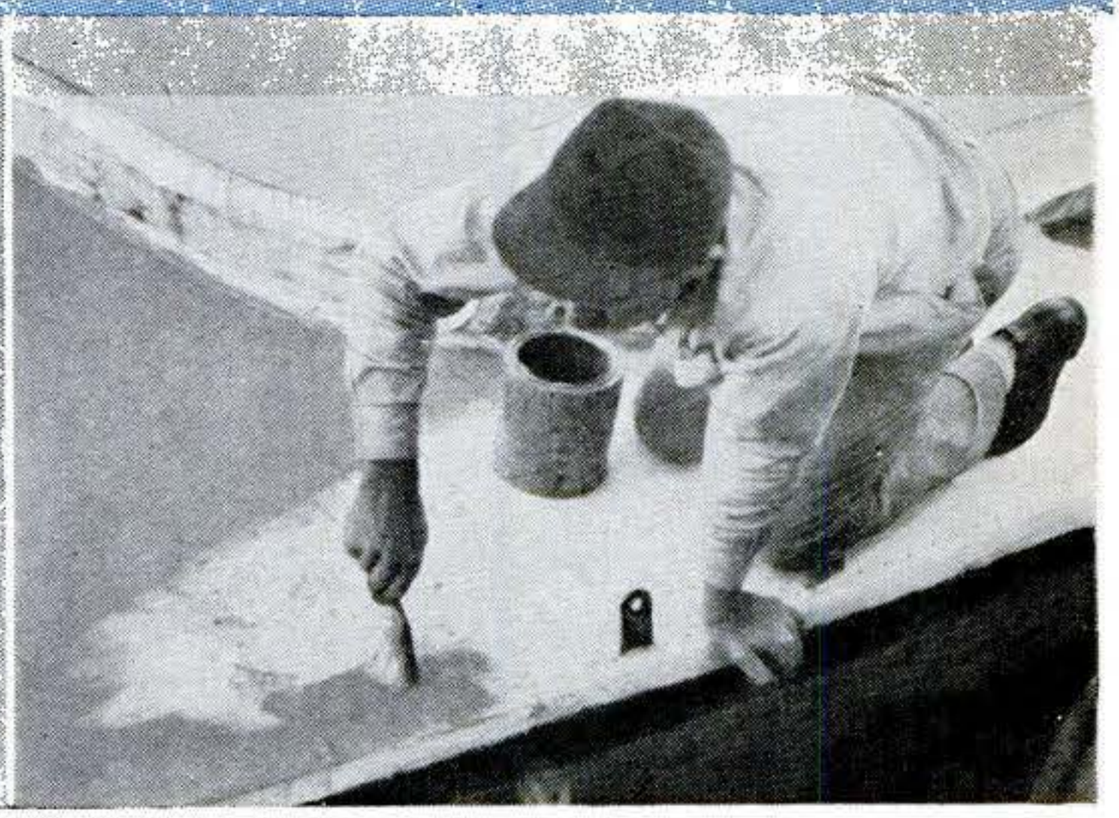
Stretching canvas over hatchway opening. Two men pull while third tacks around hatch opening. Canvas shouldn't be pulled so tightly that threads are forced out of alignment.

Slitting canvas inside hatchway opening after edges have been tacked. Sharp knife should be used. Tacks are spaced ½" apart. After this is done, coamings are put on.

Fitting lead molding around windlasses and masts is necessary to insure tight joints. Strips were cut from sheet lead and shaped as shown. This was done after canvas was laid.



Painting canvas is last step. First coat, being put on here, will be followed by three more. These should be thin. Light sanding between coats is sometimes done.



Supports Screwed Inside Table Drawer Hold Bedside Tray

Two pivoted wooden stubs in a night-table drawer will give you the extra, uncluttered table surface you need for a serving tray. Attach strips to both sides of the drawer with round-headed screws and washers. Tilt them against the drawer front, and cut them level with the table top, as shown in photo at left below.

These supports fold down into the drawer when not in use. They are handy for serving a sick person, and make breakfast in bed more comfortable, too.

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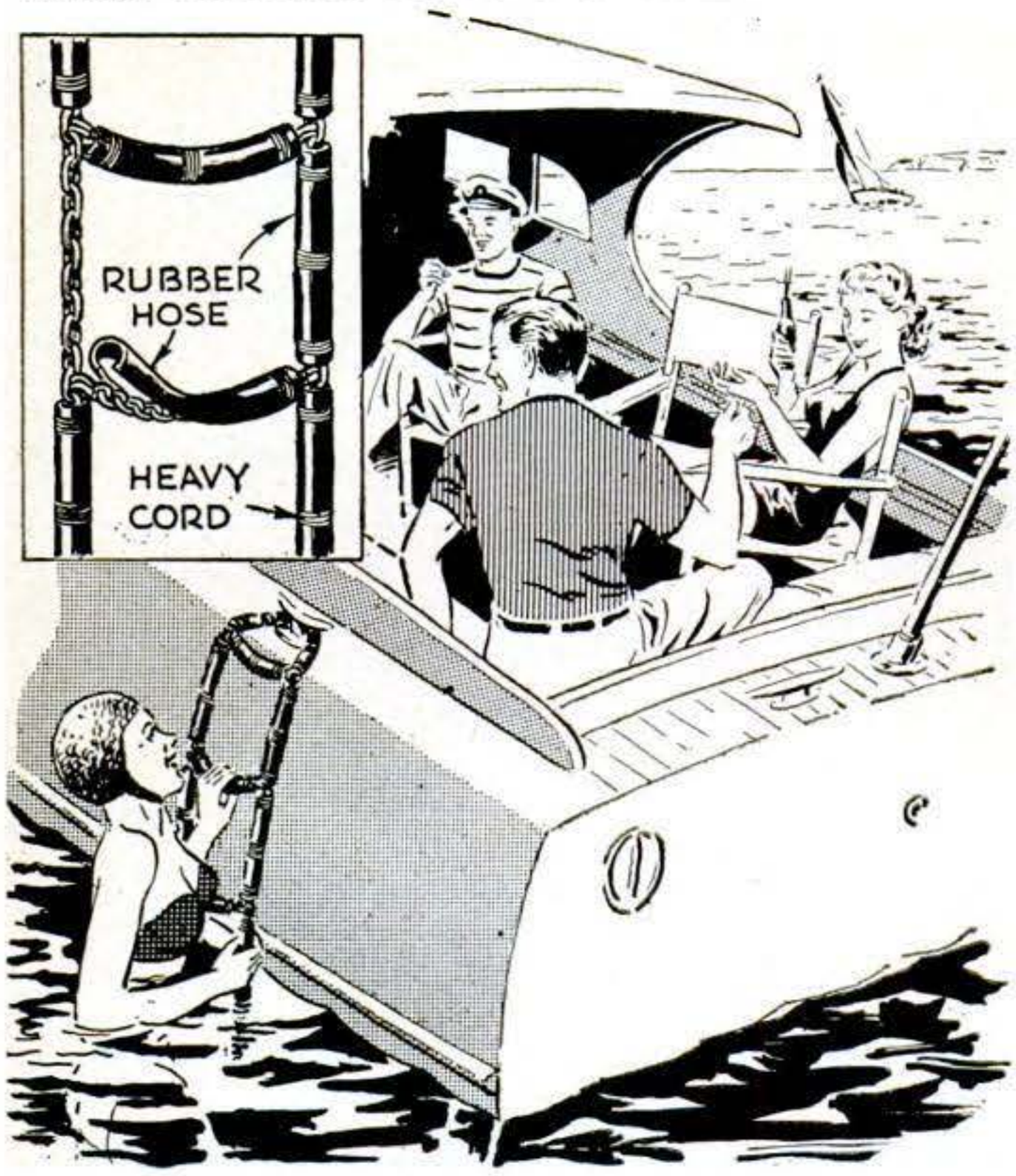
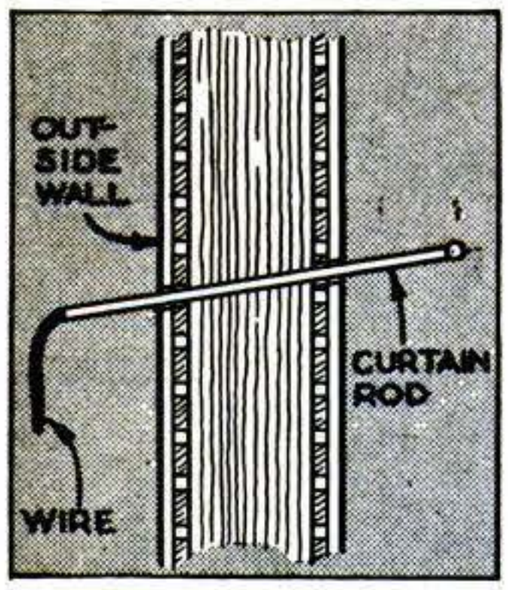
Climb Aboard on Tire Chains



OLD tire chains make good boat ladders. They're cheap, they can be stored in a small space, and their weight makes them hang straight down into the water to afford a secure footing.

The conversion job is very simple. Just remove two out of every three cross chains and cover the remaining ones to make climbing easy on the feet. One good covering is garden hose, slit, slipped over the links, and then lashed with cord. Another is brass pipe—you can cut it to length, open an end link in each cross chain, slide it on, and refasten. Hose over the upper ends of the side chains protects the boat. To retard rusting, coat with red lead, then white paint.

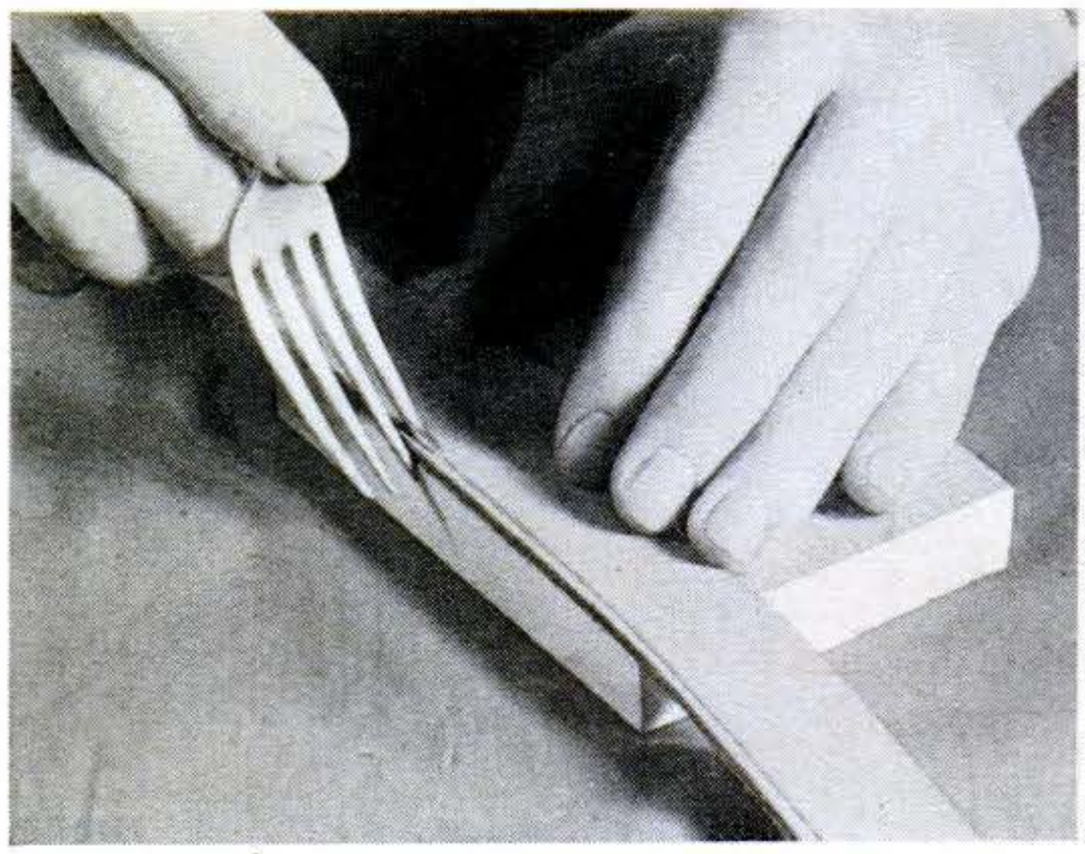
Curtain Rod Guides Wire through Wall



YOU can wriggle wire through a wall the easy way with a piece of curtain rod. It works well with any light-duty wire. Fit a few inches of wire into one end of the rod, jiggle the rod through the hole in the wall, then slip off the rod.

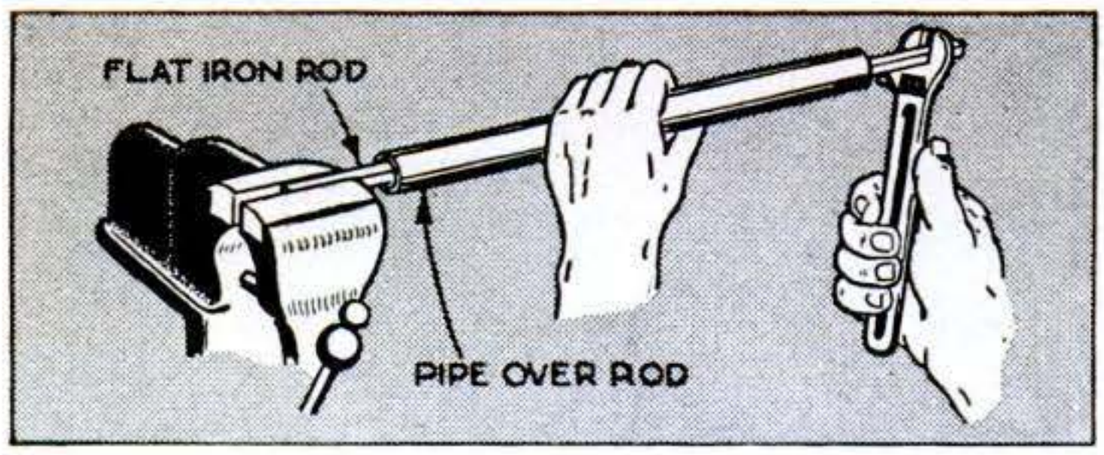
If you put the wire through an outside wall, slant the hole upward toward the inside to keep moisture from seeping in. Pack plastic weatherstripping around the hole for extra protection.—*W. H. McClay, Pasadena, Calif.*

Bent Fork Makes Leatherworker's Tool



AN OLD kitchen fork makes a good tool for leathercraft. It's especially useful for scoring lines on heavy belt leather. Place the leather on a wood block with a perfectly straight edge. Bend up an outer tine of the fork and draw this tine over the leather. The neighboring tine acts as a guide, keeping the margin always the same width.—*Don Nielsen, Aurora, Neb.*

Pipe Helps You Twist Iron Rods



WHEN twisting square rods in a vise for ornamental ironwork, put a piece of pipe over the rod before turning with the wrench. This insures uniform twists and keeps the main axis of the bar straight.—*Hugh Lineback, Stillwater, Okla.*

Color Glamorizes Fluorescent Tubes

IF THE cold, blue-white color of standard fluorescent lamps bothers you, try painting the tubes. You can get warmer tones and achieve some striking effects with liquid alcohol colors, sold at paint and art-supply stores. Try several harmonizing colors on each tube, or a single color varied in density so that it fades off and gradually darkens again in tone.—*E. F. Lindsley, North Prairie, Wis.*

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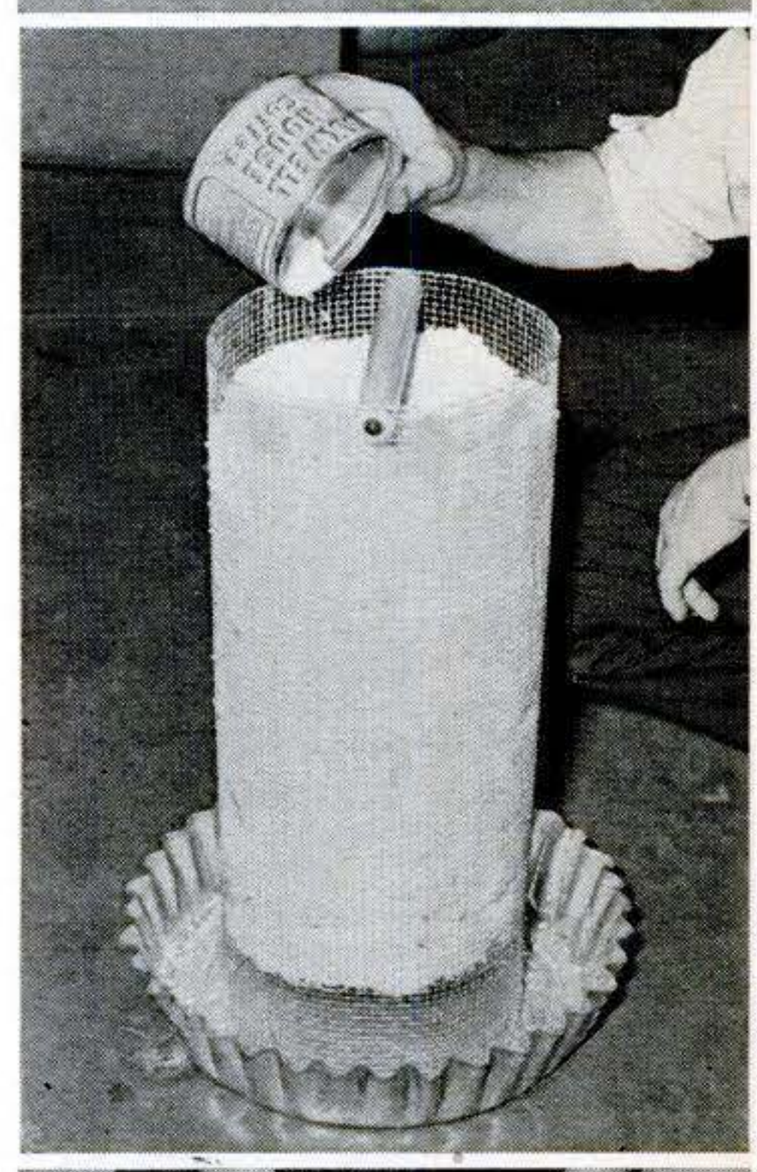

Smaller unit (above) is made like the larger one (right) but is 8″ in diameter and 16″ high. It is camouflaged by a larger cylinder of hardware cloth that fits over it.

Thirsty Chemical Dries a Damp Room

IF HUMIDITY is giving you a bad time in your workshop, or any other room, calcium chloride in this simple container will stop it quickly.

Calcium chloride is an old standby among dehumidifiers. It's available at many farm and hardware stores, as well as chemical-supply houses. Unlike silica gel, it cannot be reused, but it costs much less—about 30 cents a pound.

The container is designed to expose the maximum amount of dehumidifier to the air. It is made of ¼″ hardware cloth of 24″ width. Roll up a cylinder of the cloth, 10″ in diameter, allowing 6″ overlap. Lace the overlapping edges of the cloth with picture wire (photo at top right).

Lace a 10″ circle of hardware cloth in the cylinder 4″ from one end. Drop a circle of cardboard on the wire circle to form a bottom. Screw on a piece of broom stick for a handle. Fill the container and place in a pan to catch the water.—*Ivan Grosvenor, Richmond, Ind.*

Repairing cracks in stucco walls is easy. See PS next month.

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The earth bulges at the equator because of centrifugal (center-fleeing) force produced by its rotation. A loop of stiff paper, mounted on a pencil that fits the mixer chuck (below), represents the earth. The faster you spin the loop, the more its middle bulges outward (left). Centrifugal governors on steam engines work the same way.

Kitchen Mixer Answers $64 Science Questions

It was meant to beat cakes, but it can also demonstrate some of physics' most curious facts.

By Kenneth M. Swezey

WHY does the earth have a pot belly—a bulge at the equator making its diameter there about 26 miles greater than from pole to pole?

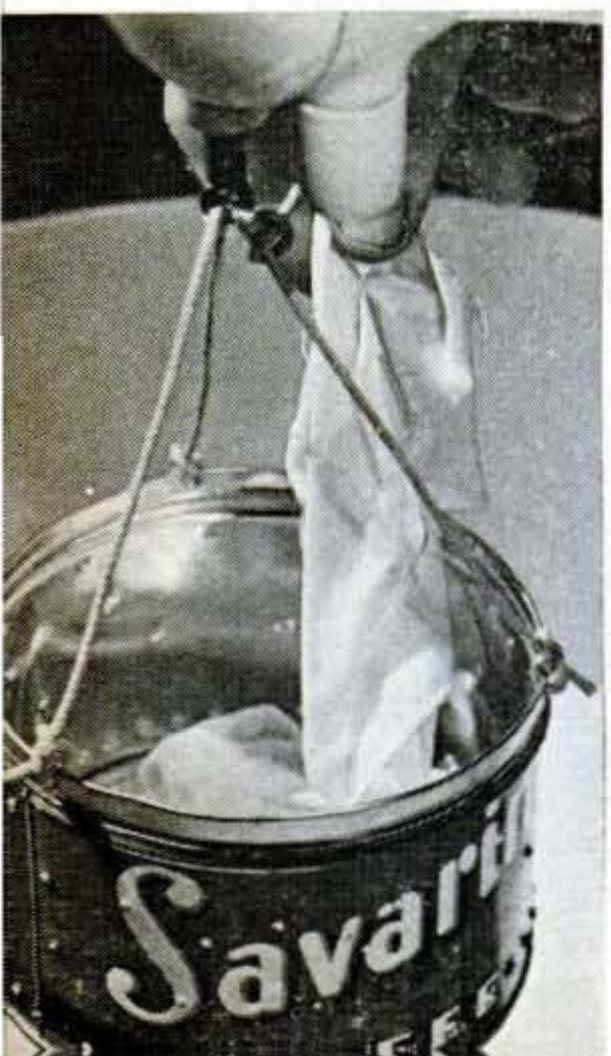
How does a washer spin-dry clothes?

How does a cowboy spin his lariat?

How does a cream separator work?

An electric kitchen mixer will answer such $64 questions in an evening's science fun for the whole family. Use a mixer having a variable speed control. Most of the experiments here can be done with a 2½" dowel or pencil stub pressed into one chuck, with a small screweye turned into its end. Use the other chuck for reverse rotation.

And when you're through with the scientific tricks, you can put the mixer right back to work beating up a batch of waffles.



In a washer, wet clothes are whirled at high speed in a perforated cylinder. Centrifugal force throws out the water. A whirling coffee can punched full of holes (left) demonstrates this. Revolve it as at right. Centrifugal force is used commercially to dry sugar and salt.

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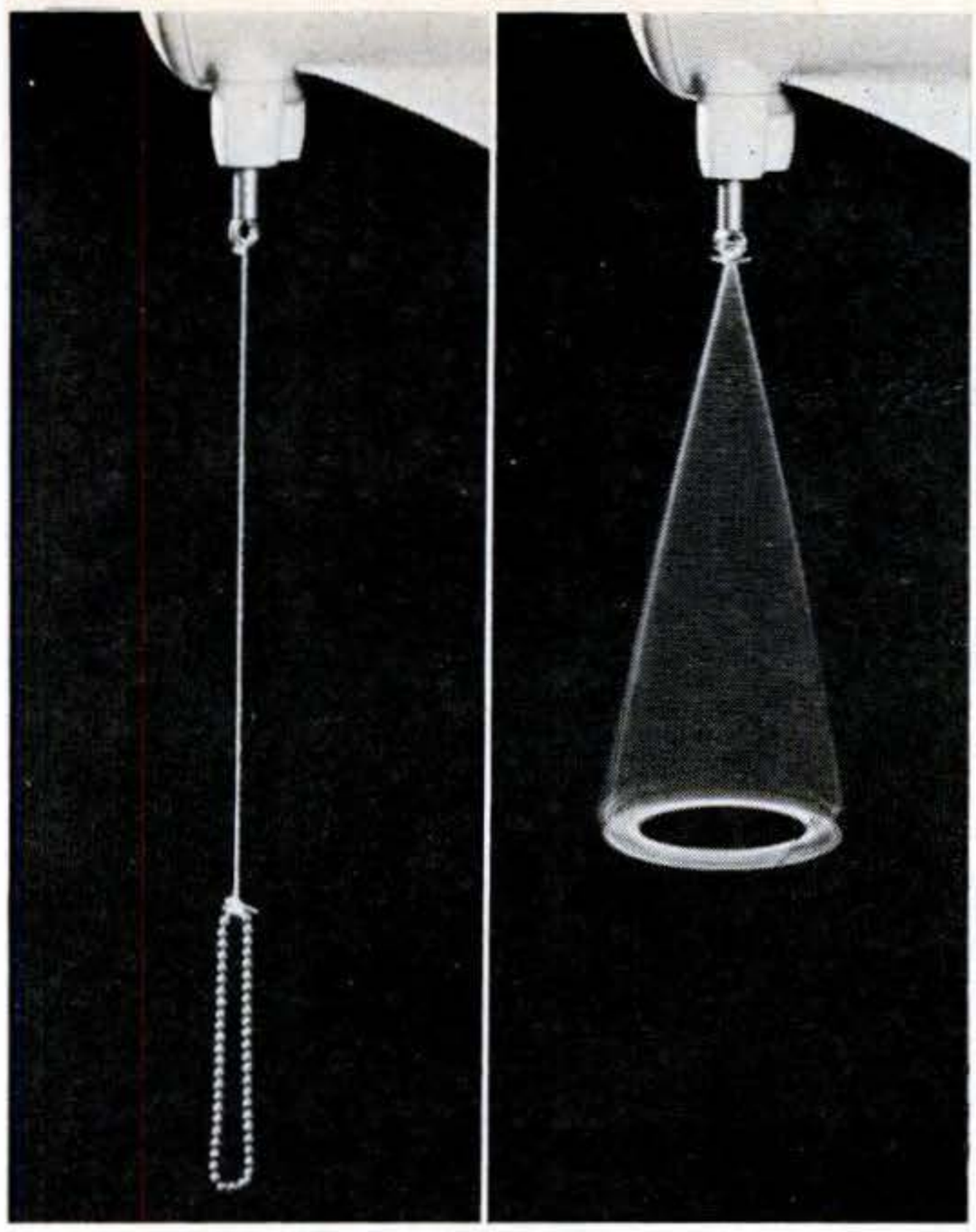
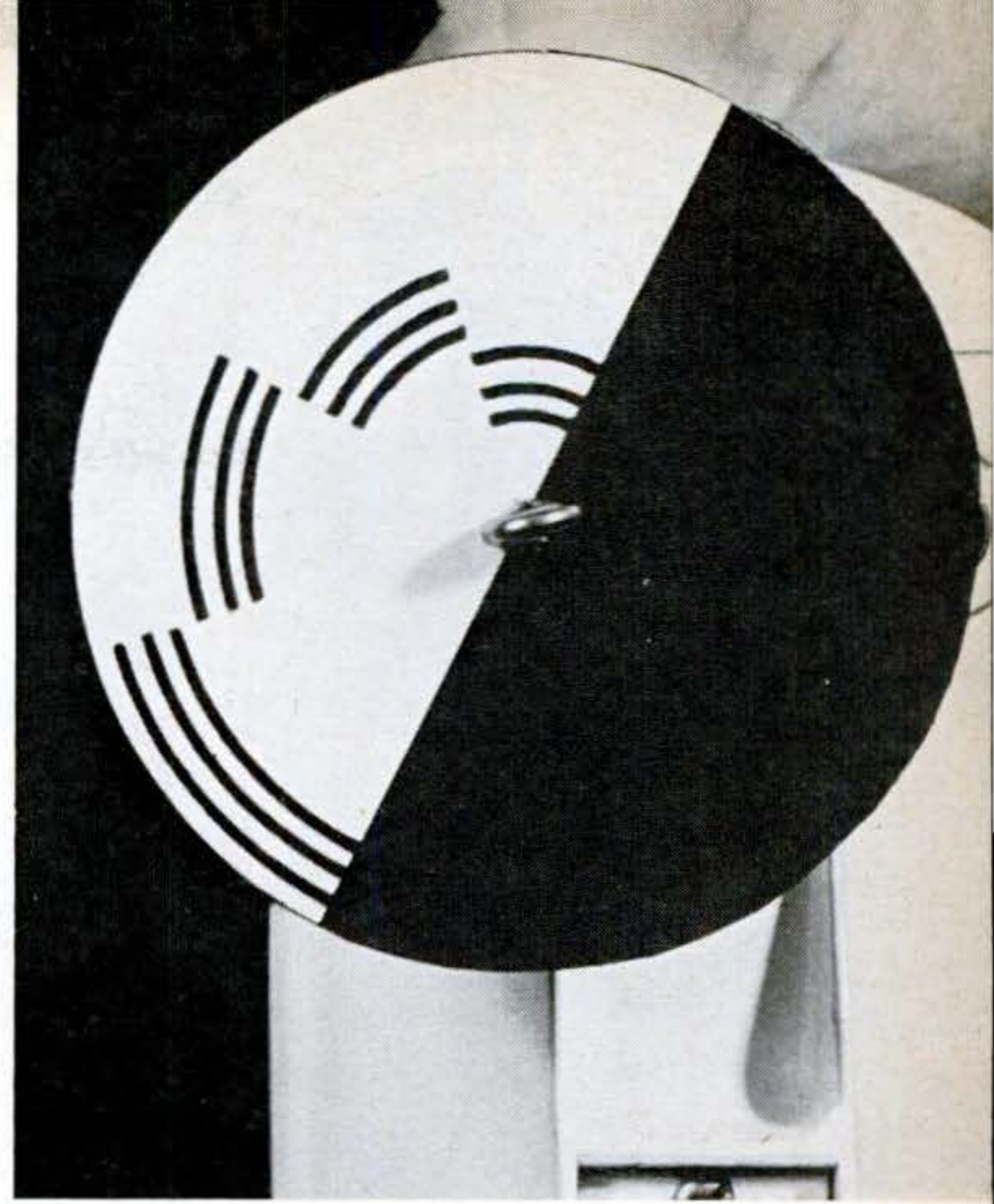


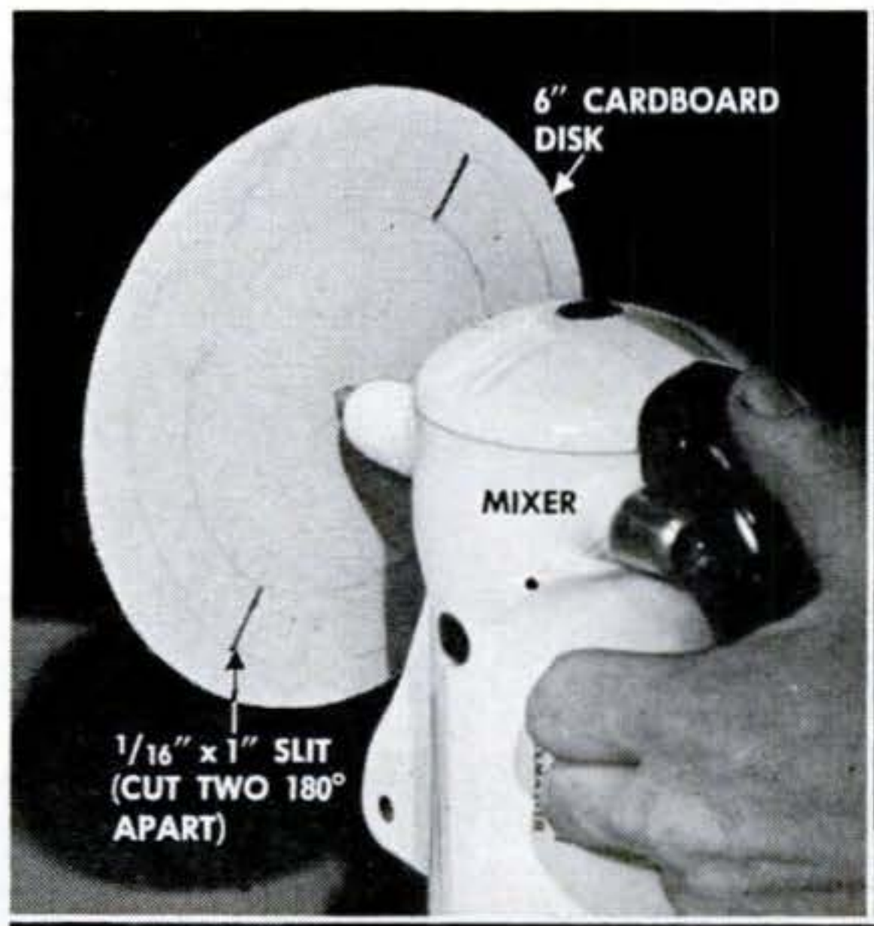
Spinning a lariat. You can see the science involved by fastening a 3″ loop of electric-light chain to a 7″ string tied to the mixer spindle. Start mixer slowly and gradually build up speed. As speed increases, loop will open and its bottom rise. Finally loop will spin on its side in a circle. Centrifugal force raises it until greatest amount of its weight is as far as it can get from the axis. Lariat loops spin in an open circle for the same reason.

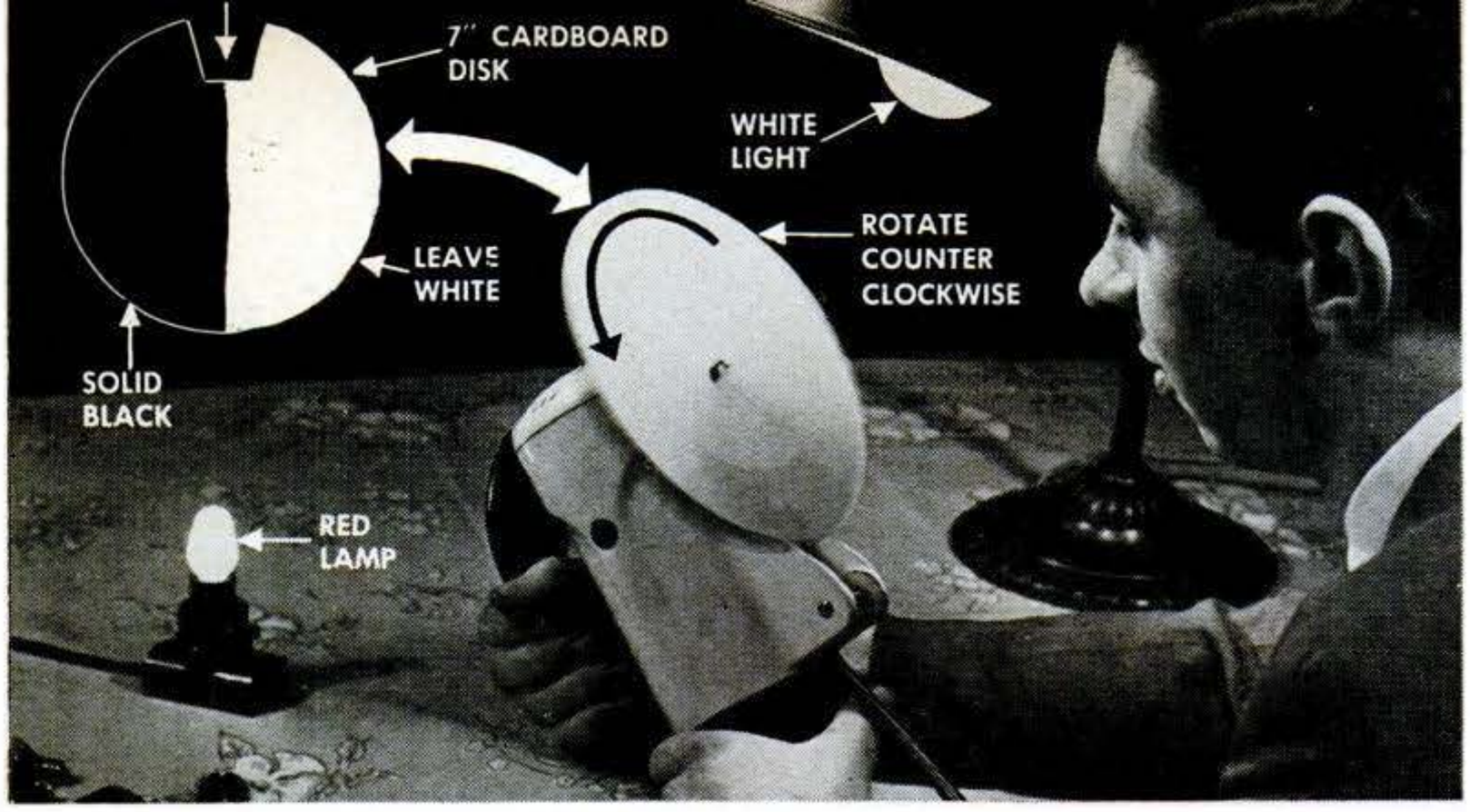


Here's a real puzzler. Blacken half of a 4″ disk and draw sections of circles with black ink on other half as shown. Rotate this disk slowly under strong white light, and arcs of black ink seem to change to circles of four different colors. Reverse the rotation, and colors appear in reverse sequence. Scientists say illusion is related to rate of growth and decay of color sensations in eye and mind—but the principle is still imperfectly understood.

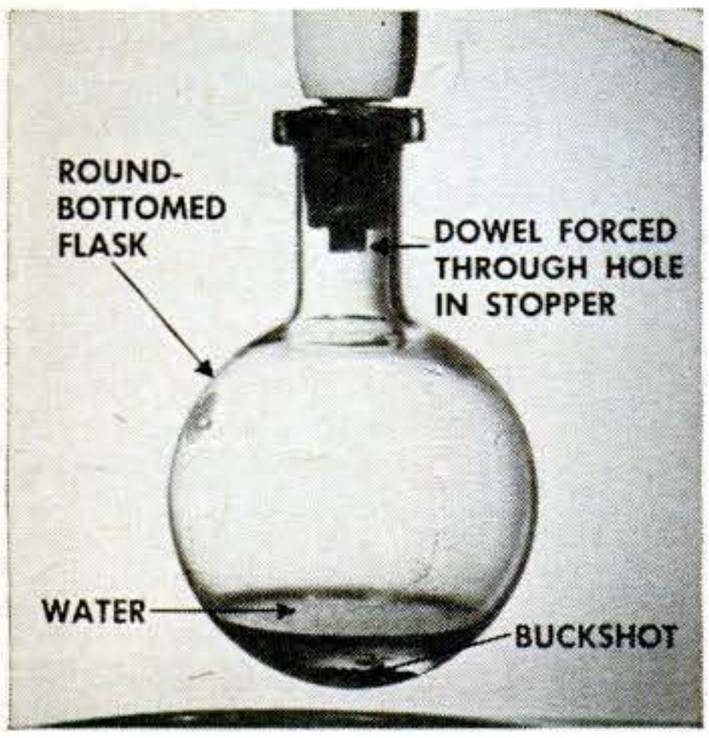
How a stroboscope shows up flaws in rapidly moving machinery is another experiment you can perform. (A stroboscope makes revolving or vibrating parts seem to slow down or stand still.) Cut a sheet of cardboard to represent a broken "gear." Spin gear in an electric drill and view it through the revolving slits of a stroboscope improvised as shown. Carefully adjust the speed of the mixer motor and you will find one point at which the gear seems to stand still, revealing broken tooth. When this happens, the stroboscope slits are passing your eye at same rate gear is revolving. You see gear for fraction of a second in same position each time it revolves. Persistence of vision blends these images into one. You can also "stop" electric-fan blades, the hammer of a vibrating bell, or alternating-current fluctuations.

[*Continued on next page*]

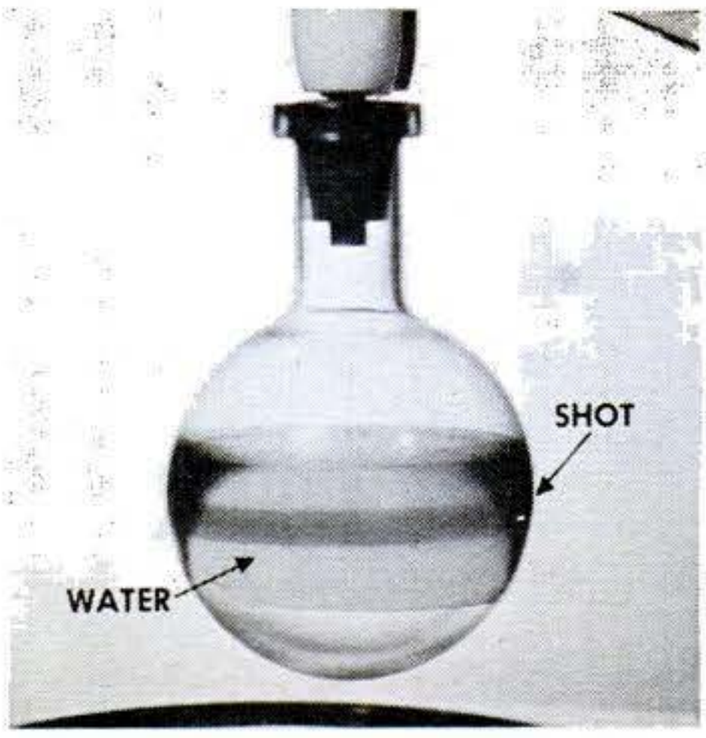




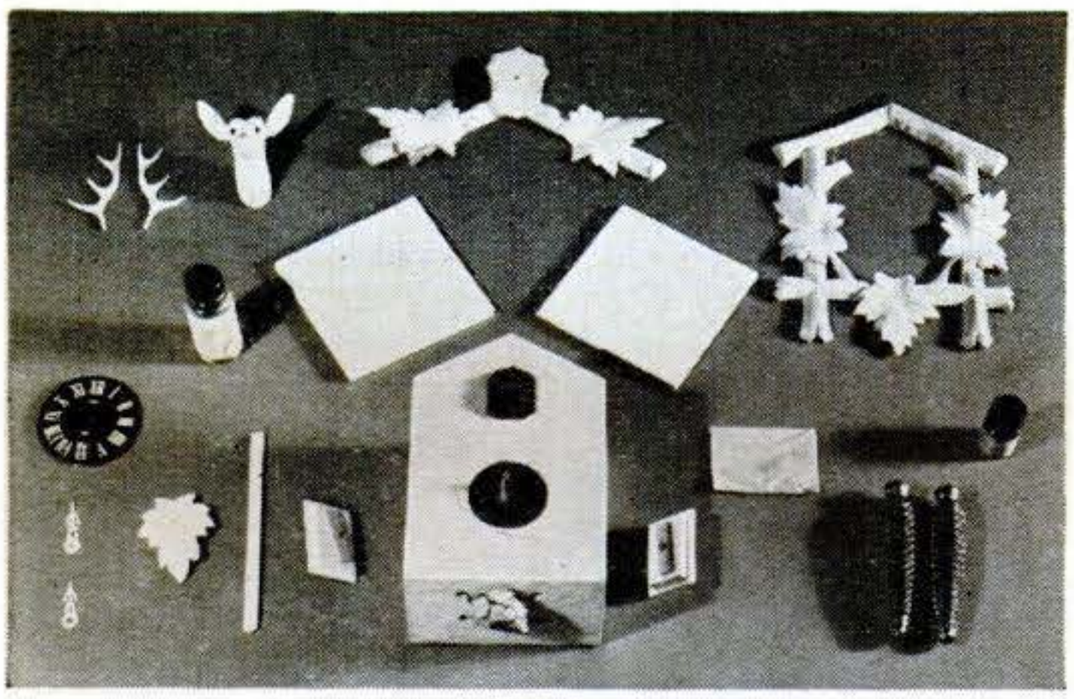
Red lamp turns green if you view it through slot of this disk, revolving slowly counterclockwise. Scientists say that this illusion is caused by retinal fatigue. The eye tires of the color it sees every time the opening in the disk passes, and so creates an image of complementary color on white section of disk. Speed up disk, or reverse direction, and illusion vanishes.



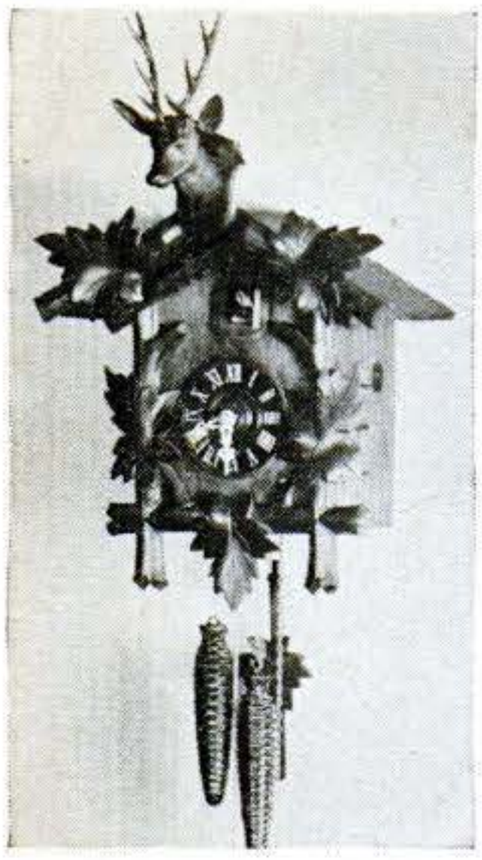
Cream separator. If two bodies of different weight are rotated at same velocity, the heavier one pushes out with greater force than the lighter. Start up mixer after assembling the setup at left, making sure fittings are tight and flask exactly centered. The shot will form a ring around widest part of flask with water in rings above and below. Cream is separated from milk by same principle, since the cream is lighter. Laboratory centrifuges separate chemicals in same way.



Cuckoo Clocks Assembled from Kits



CARVINGS, works, and all parts are included in these cuckoo-clock kits. The works come mounted in place and ready to run. You assemble the other parts and stain the case. The kits, priced from about $13 to $30, are imported from Germany. According to the importer, J. F. Reich, of Quivira Lake, Kansas City, Kan., assembling a clock from a kit is a one-evening job.



Modeling Clay Identifies Cut Film

WHEN film holders have been loaded for weeks and you don't trust your touch to identify the notches, unload in the dark and press the notched edge into modeling clay. Then look at the clay in the light.

Shoptalk:

What are they talking about? Where do they work? Answer below.

They're steel workers. A bug is a small particle of steel that solidifies on the nozzle of a ladle for molten metal and interferes with pouring. The bug causes spraying during pouring. This in turn causes the ingots to have a poor surface that might require scrapping or expensive surface conditioning.

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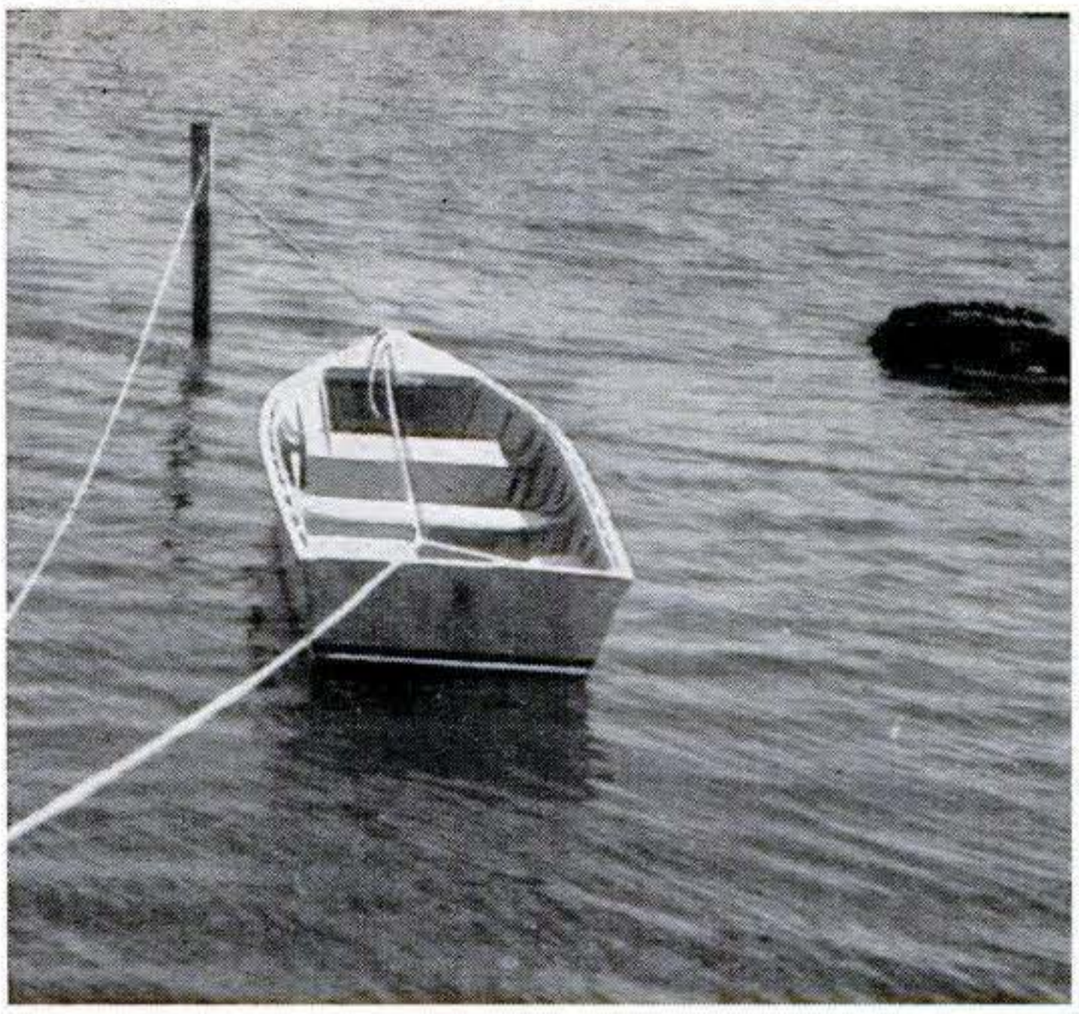
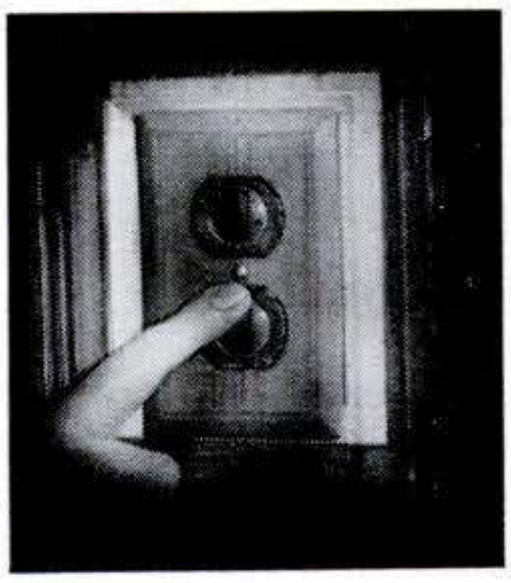
Pulley Line Used to Moor Boat



MOOR your boat like this and you won't have to worry about it banging against the dock. Mount one pulley high on a piling and another pulley on the dock. Run a continuous line through the pulleys. To moor the boat, secure the line at bow and stern, as shown in the photo. Pulling one line hauls the boat away from the dock and the other hauls it back. Use this rig only in sheltered moorings, and leave slack if there's a tide.

Decals Locate Objects in the Dark

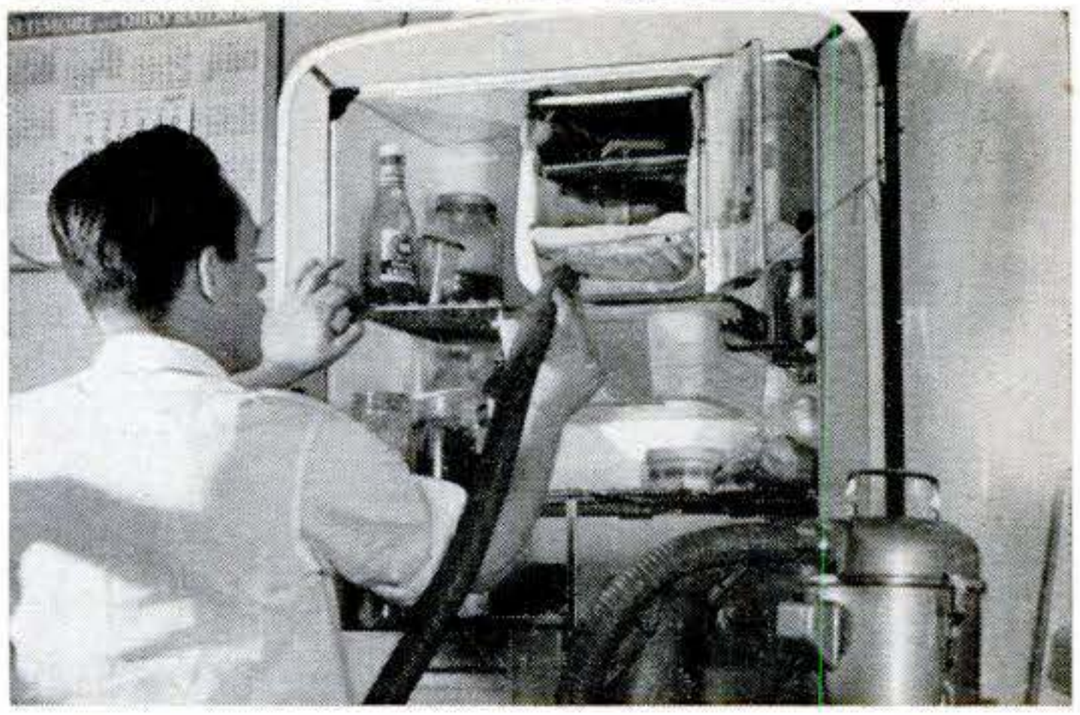
LUMINOUS strips that can be applied like decalcomanias are now available. Called Safti-Cal, they're recommended for use on stairs, switch plates, in darkrooms, and for making night-visible signs. A product of the Meyercord Company, of Chicago, each package contains more than nine feet of half-inch strips, and sells for 69 cents.



Outlets Now Easier to Install

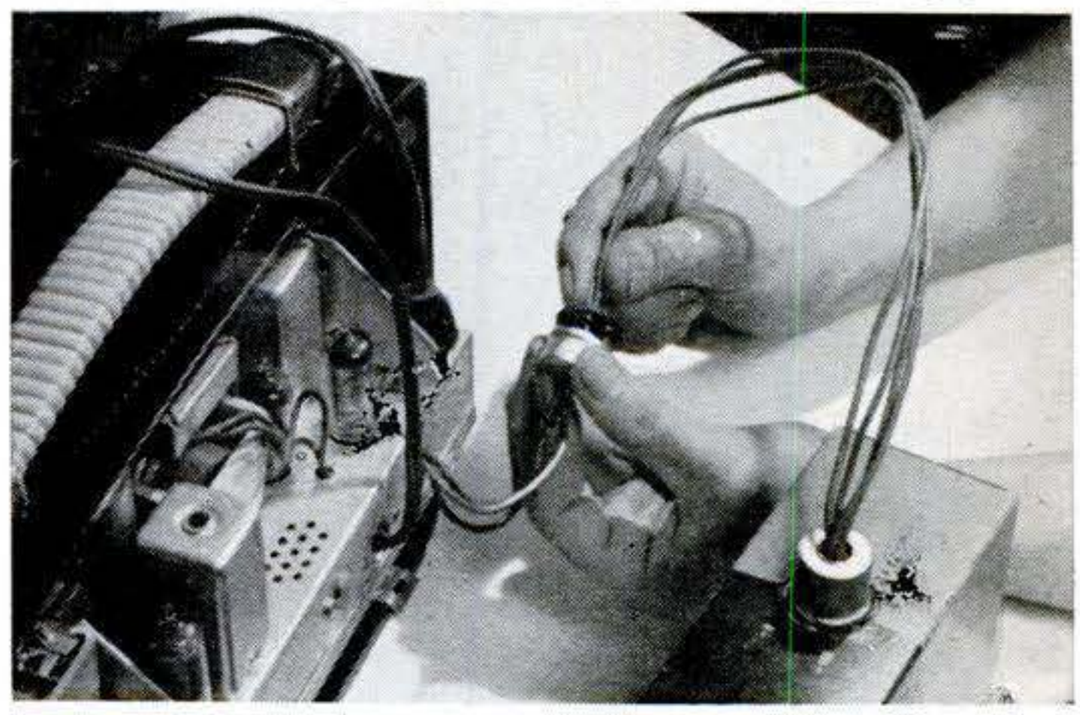
THESE two receptacles simplify the task of installing or replacing electric outlets. The plastic unit at the immediate right, made by John I. Paulding, Inc., New Bedford, Mass., combines a double receptacle and wall plate in a single molded piece. The outlet at far right, a product of Monowatt Inc., Providence, R. I., can be connected without looping or twisting wires. It uses flat metal wire clamps in place of the usual binding screws. Both receptacles are made to fit standard outlet boxes and are UL approved.

Vacuum Defrosts Refrigerator Fast

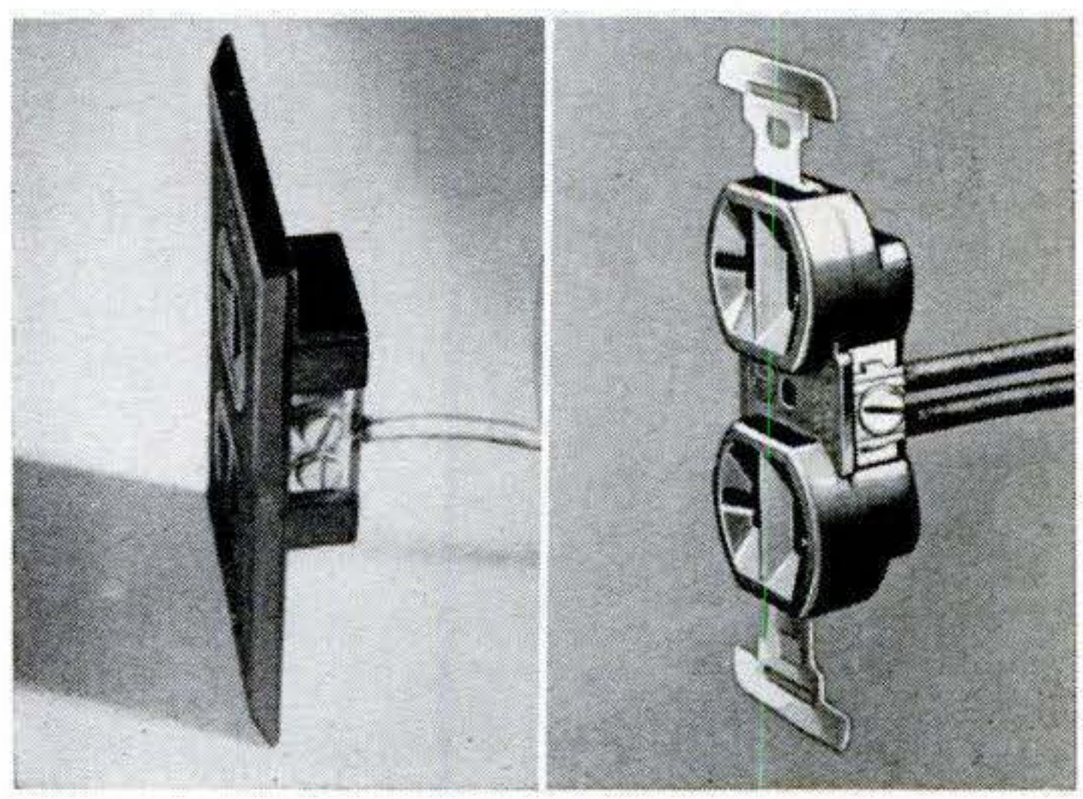


THE blower end of our vacuum-cleaner does a fast job of defrosting our refrigerator. We just insert the hose in the freezer compartment and direct a stream of air on the frost. The ice drops free in about seven minutes, and frozen foods removed from the refrigerator can be popped back in again before they have a chance to thaw.—*E. F. Lindsley, North Prairie, Wis.*

Extension Leads for Radio Batteries



EXTENSION leads that enable you to separate the chassis from the battery of your portable, as above, give easier access to the receiver for servicing. You can buy matching plugs and sockets at many radio-parts stores, or you can use connectors salvaged from worn-out batteries.



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A Super Camera Stops the Show

PS Photos by W. W. Morris

Tightrope Walker—1/200 sec.

The Flying Concellos—1/800 sec.

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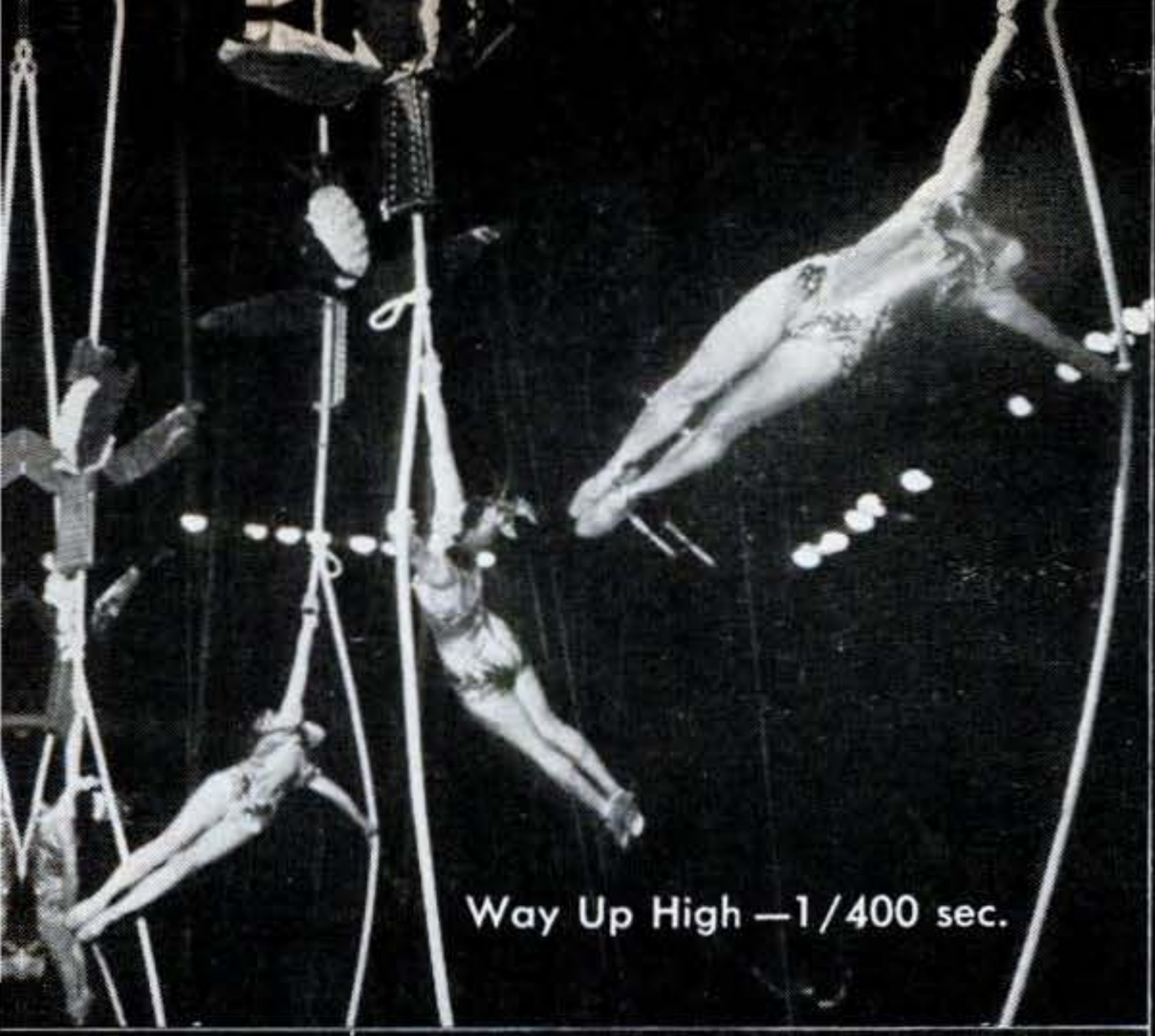
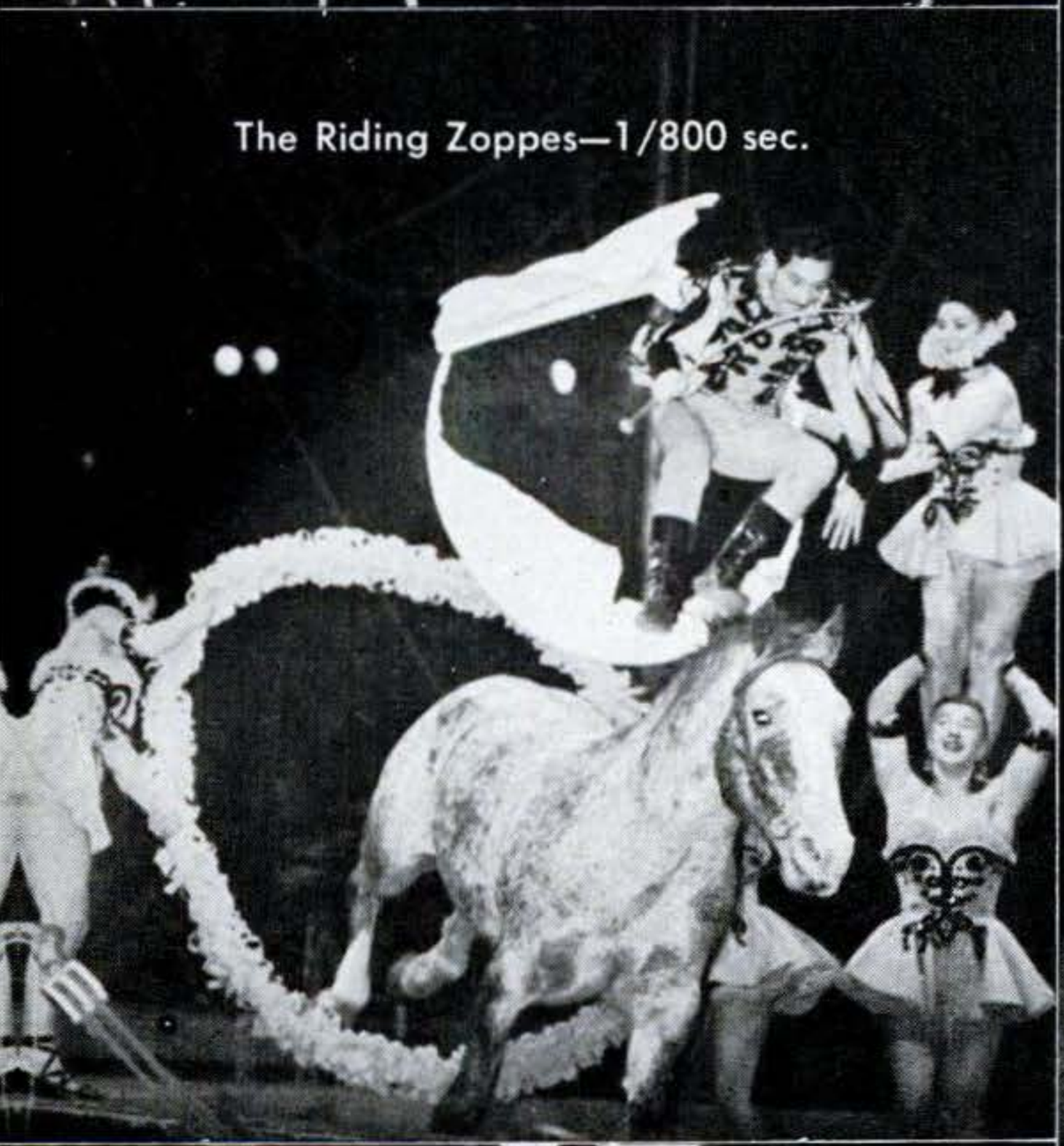
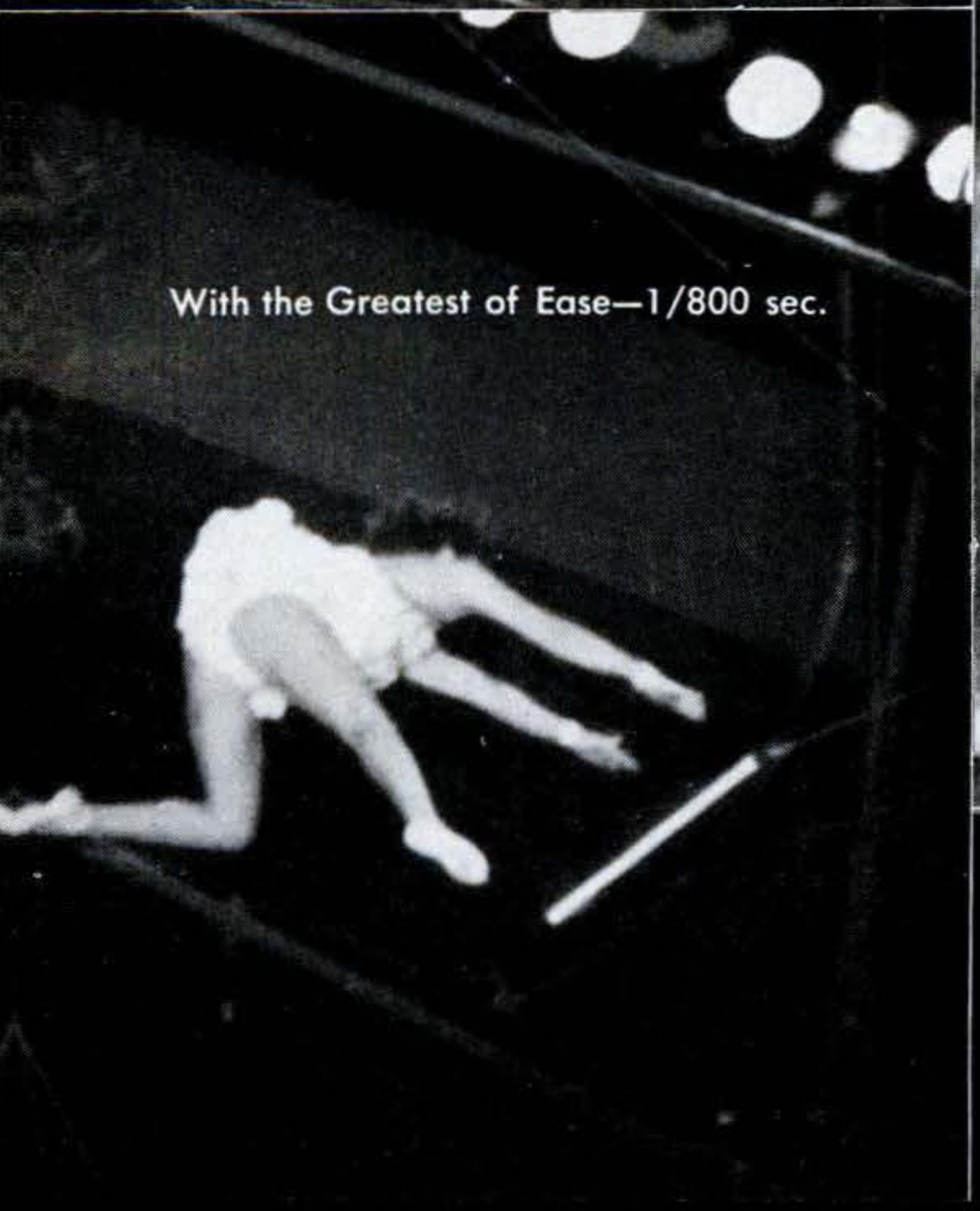


Way Up High —1/400 sec.



The Riding Zoppes—1/800 sec.



With the Greatest of Ease—1/800 sec.

Juggler Veronica Martell—1/1,600 sec.

Ever try to shoot circus pictures from the peanut gallery? It can be done. To see how one man did it, please turn the page.

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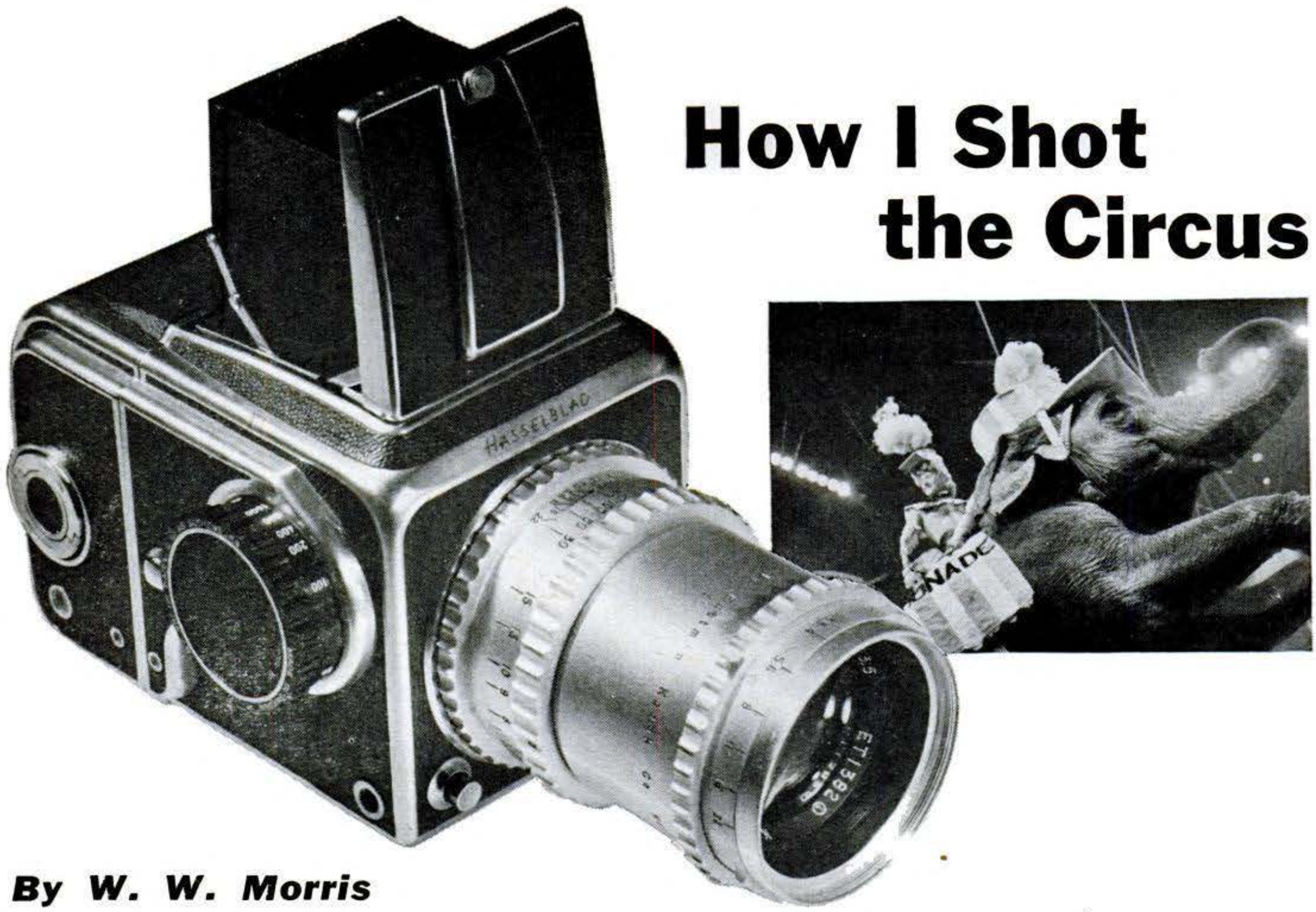
How I Shot the Circus



By W. W. Morris

SHOOTING action circus photos has always been tough. I know because I've tried. But this time I had a Hasselblad.

This handful of precision machinery from Sweden is just about the prettiest job for off-the-hip shooting I've ever seen. It packs into one black box all those features that make you wish for the Leica when you're lugging the Graphic and long for the Rollei when you have the Leica.

I shot lots of pictures to get the ones shown. And I shot them fast. A quick turn on a big, easy-to-find knob moves the film and cocks the focal-plane shutter.

It's got a bayonet lens mount, so you can switch lenses to your heart's content. An 80-mm. coated f/2.8 Ektar is standard. But at Madison Square Garden, I needed a long lens, the 135-mm. f/3.5 Ektar shown above. I shot wide open on Super XX, usually with a No. 6 flash fill-in. Synchronization, both flash and strobe, is built in.

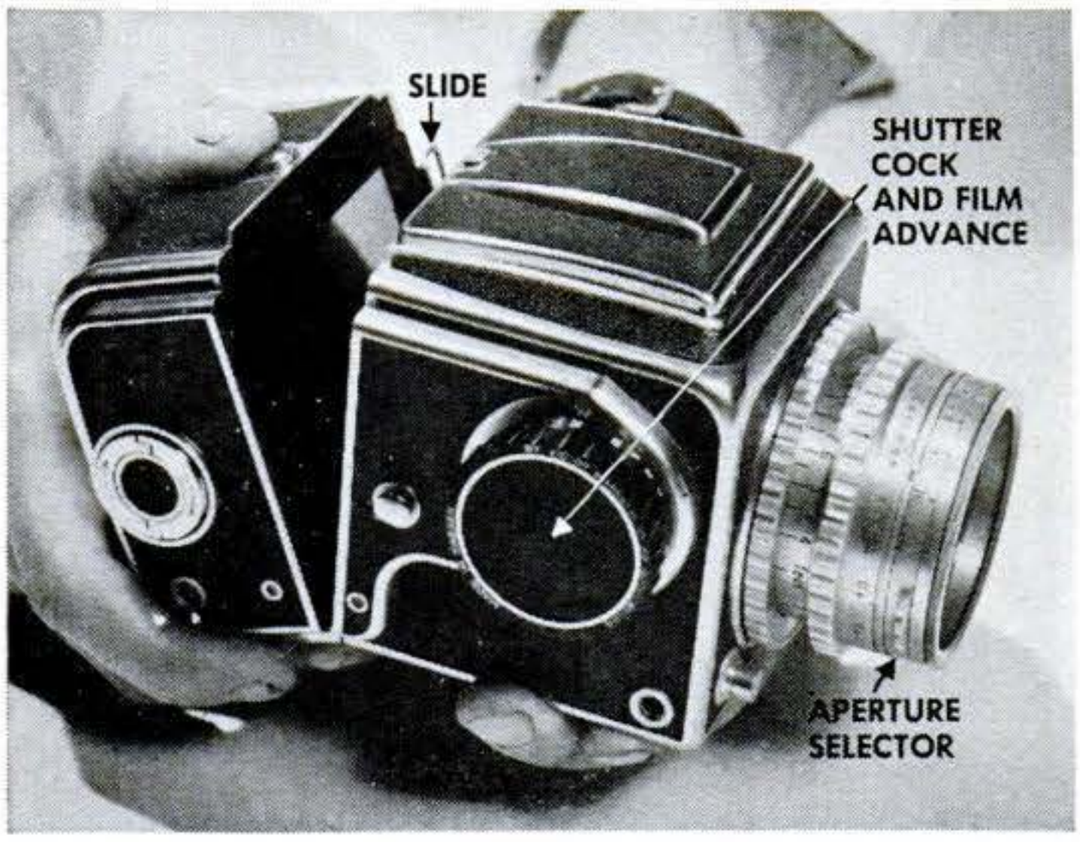
The circus gave that Hasselblad shutter a real workout. It's something—going way beyond most jobs to 1/1,600 sec., which I used to stop the lady juggler. You can even change speeds with the shutter cocked.

And magazine loading, too. No need for a second camera and a film-loading assistant to keep you on the firing line—just clip on a new magazine. Don't think that wasn't appreciated at the big show, with three rings in action, plus clowns.

Hassie is a single-lens reflex, so you've got to open the lens wide to focus in poor light. But there's an aperture pre-selector. You set the stop, flick it open to focus, swing it back to stop down—and shoot.

Naturally, they don't give Hasselblads for box tops. The basic outfit (one lens) costs about $550 at Willoughby's, New York.

A photographer of champion dogs tells the tricks of his trade in PS next month.



Safety features. You can't remove magazine if slide is out, shutter won't work if slide is in. And you can't double-expose because the film is advanced when you cock the shutter.

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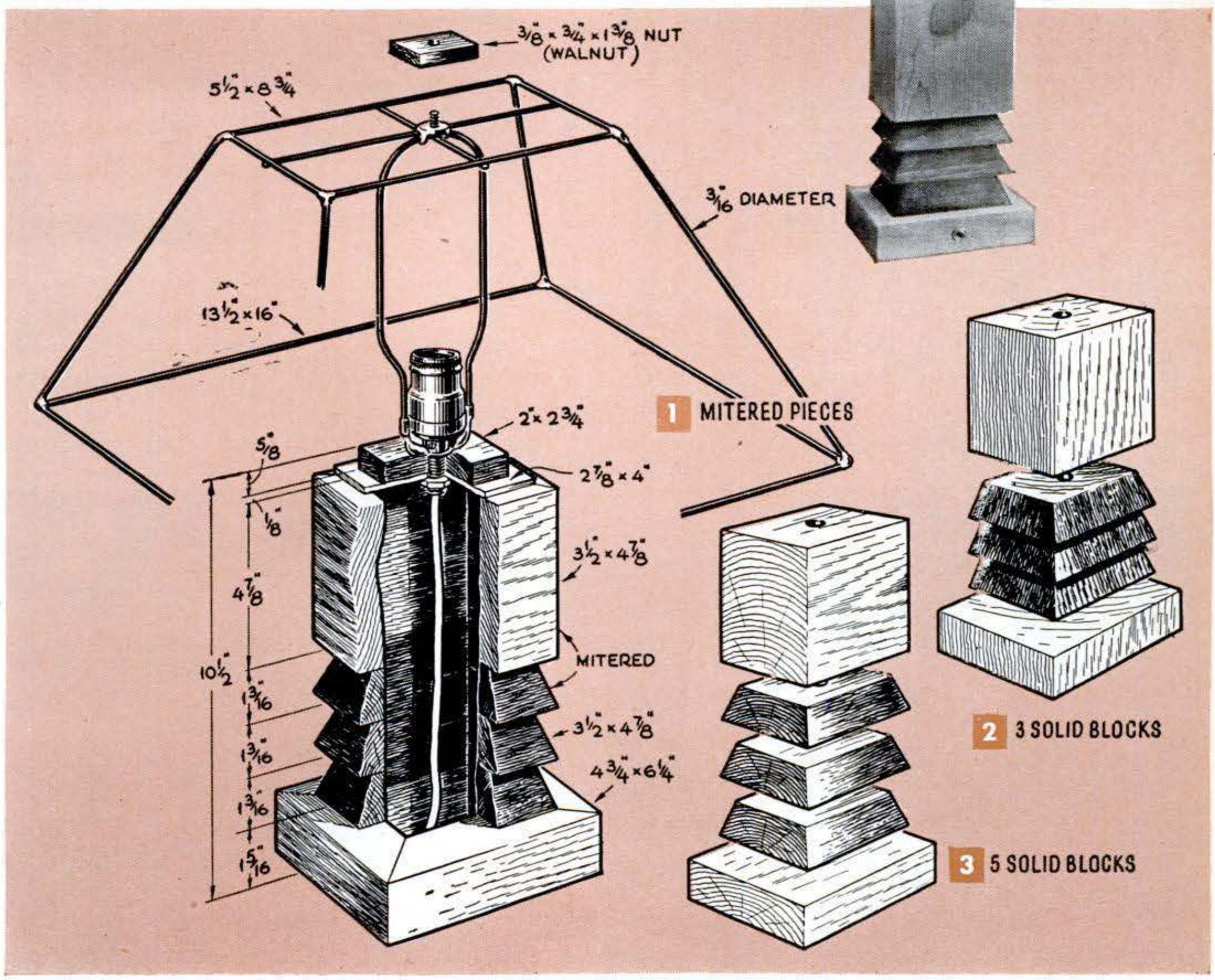
Three Ways to Build the Same Lamp



You can make it from solid blocks or from boards and strips. Choose the grain effect that pleases you most.

By Edwin M. Love

THIS good-looking lamp can be made in three ways, depending on the stock you have on hand and your woodworking skill. The mitered version (1) uses inexpensive board stock and conceals end grain on all important surfaces. Block construction offers you a choice of vertical grain all around (2), or a glued-up combination of side grain and end grain (3).

Building with miters. The upper part of the base is a maple box 3½″ by 4⅞″ by 4⅞″. Miter the four sides and glue them together. For the tiered center section, shape about 80″ of walnut strips to the cross section shown at the top of the next page. Miter six 3½″ and six 4⅞″ lengths. Use the rest to build a gluing frame like the one shown. Line the frame with wax paper and glue up each tier in turn.

Make the bottom of the base from four mitered pieces of maple. Then glue the walnut center and maple bottom together.

The ⅛″ maple step and ⅝″ walnut block that top off the base are simple square-cut pieces. Glue them together and drill them both ⅜″ to take a 1½″ length of ⅛″ threaded pipe nipple. Secure the nipple by threading on a nut and lamp harp, glue the step and block in place, and glue the top unit to the tiered center.

Building with blocks. Saw the maple top and bottom to size. To make the center, draw lines around a block of walnut where the tiers go, make straight saw cuts on the

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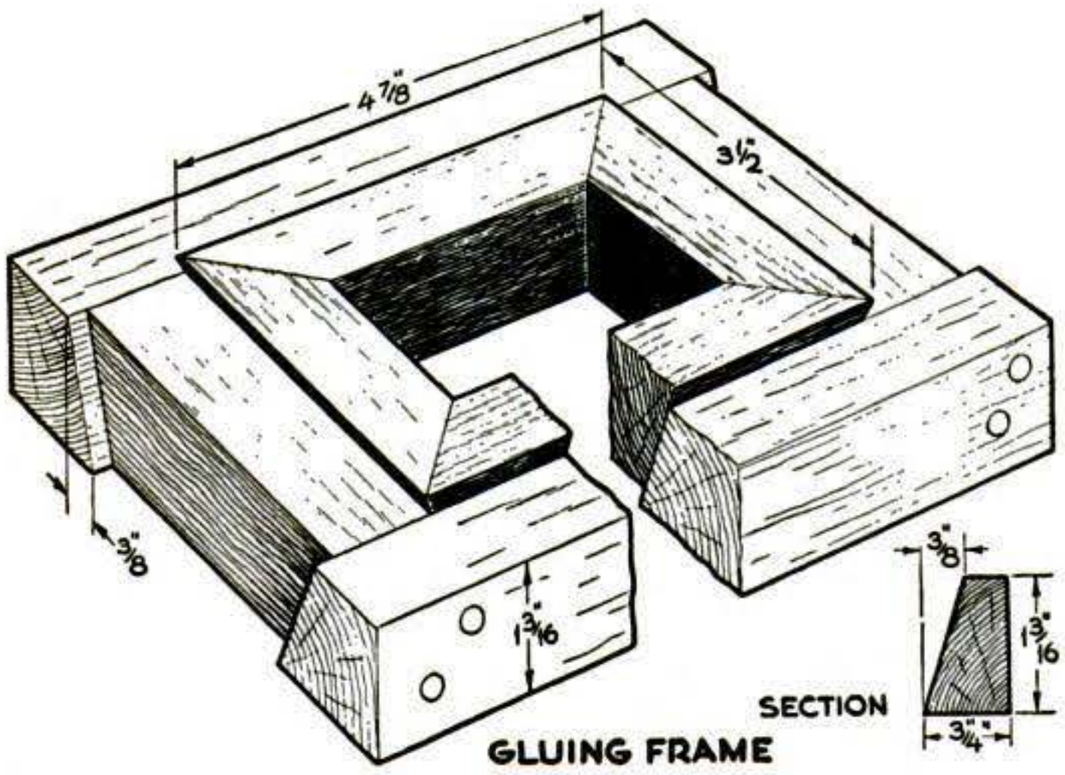
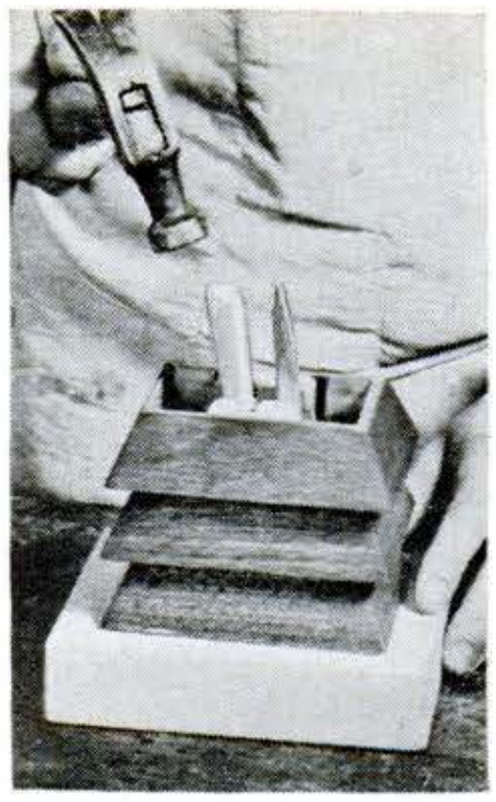


lines, and chisel the tapers. If you don't mind exposed end grain, you can make the tiers out of individual blocks.

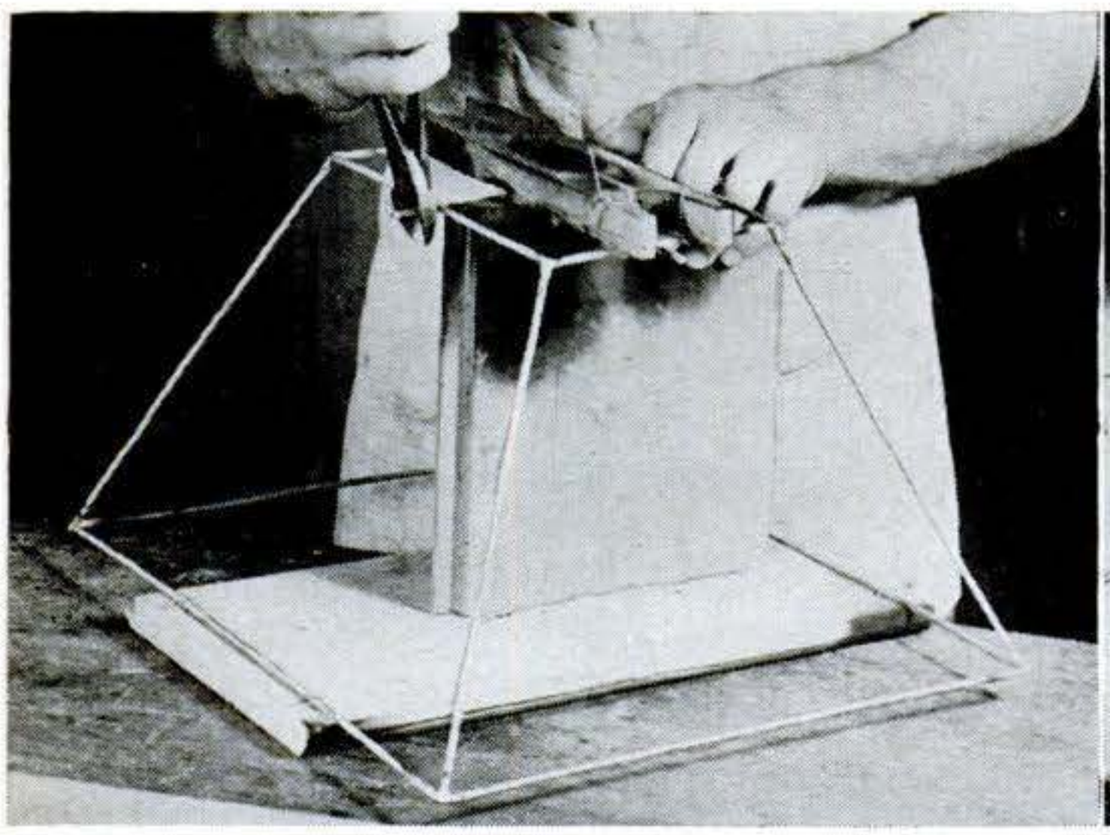
Drill a ⅜" hole for the wire through the center of each section and join the blocks with screws and glue.

After corners are glued, reinforce mitered center section by gluing blocks inside. Wedge them lightly until the glue sets.

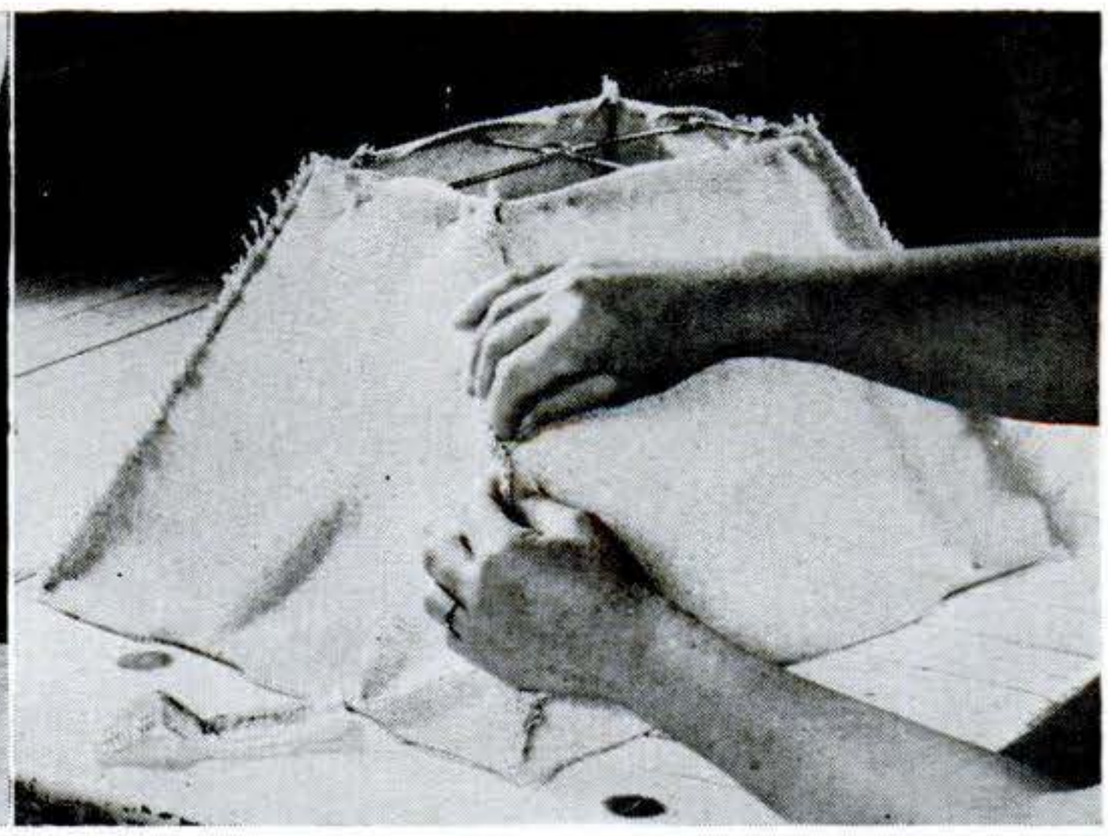


You'll have to counterbore the top block to about ½" of the bottom in order to screw it to the tiered center. Place the counterbored holes where they will be covered.

The shade. The wire frame can be built up from ⅛" Bessemer rod or heavy coat-hanger wire. If you solder or braze the joints, make a holding jig like the one shown at the left below to simplify assembly. Monk's cloth makes a good shade covering.

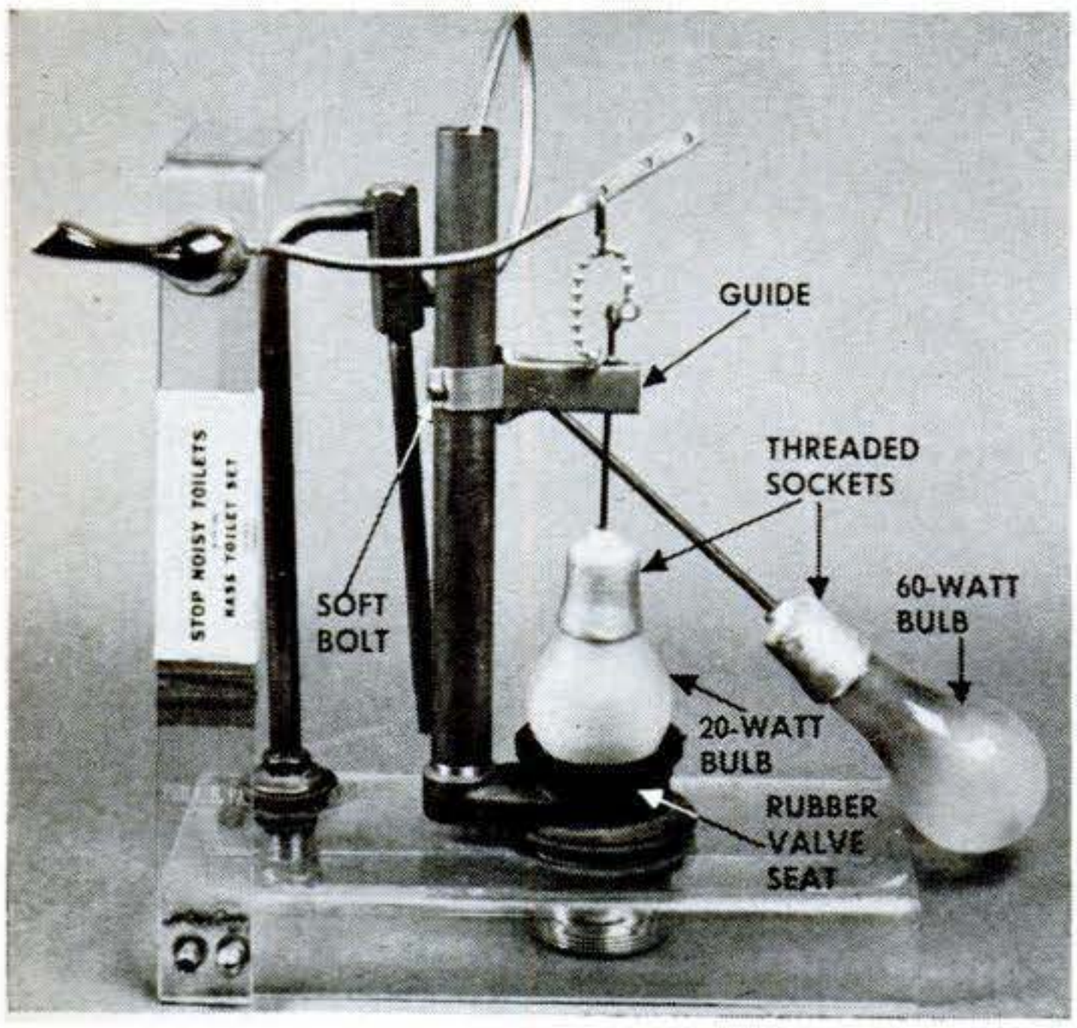


Build shade frame on a T support. After joints are brazed, clip off projecting ends of wire and remove the framework from T support.



Sew the monk's-cloth cover with seams on the outside. Then remove the cover, turn it inside out, and stretch it over the shade frame.

Discarded Light Bulbs Replace Flush Valve and Float Ball



SOMEBODY has finally found a use for burned-out light bulbs. Tackling the old problem of the leaking flush valve, Samuel Kass, a Philadelphia inventor, designed a rubber insert to fit the worn brass valve seat that usually causes leaking. Then, seeking a perfect ball to fit, he hit upon using a discarded light bulb.

The valve assembly kit consists of the rubber insert, a rod with a socket for the bulb, and a guide to clamp on the overflow pipe with a soft bolt that can be bent to fit various pipe sizes.

Also available is a rod and socket for replacing leaky copper floats with a light bulb. It's claimed that this can't leak, and is easily replaced at no cost if broken.

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Hall Light Cools the House

A grid made from 5/16″ by 1¾″ lattice strips is supported by a 1″ by 4″ frame screwed to the ceiling. The grid hides the opening to the attic and diffuses a soft light over the hall.

A CEILING vent like the one shown here can brighten a house while it cools it. The brightness comes from an inexpensive fluorescent fixture that sweeps the shadows out of the upper hall. It cools by letting the warm air rise into the attic where it can be sucked out by an exhaust fan. An attic fan combined with such a vent is a simple form of air conditioning. The vent itself is a simple woodworking job.

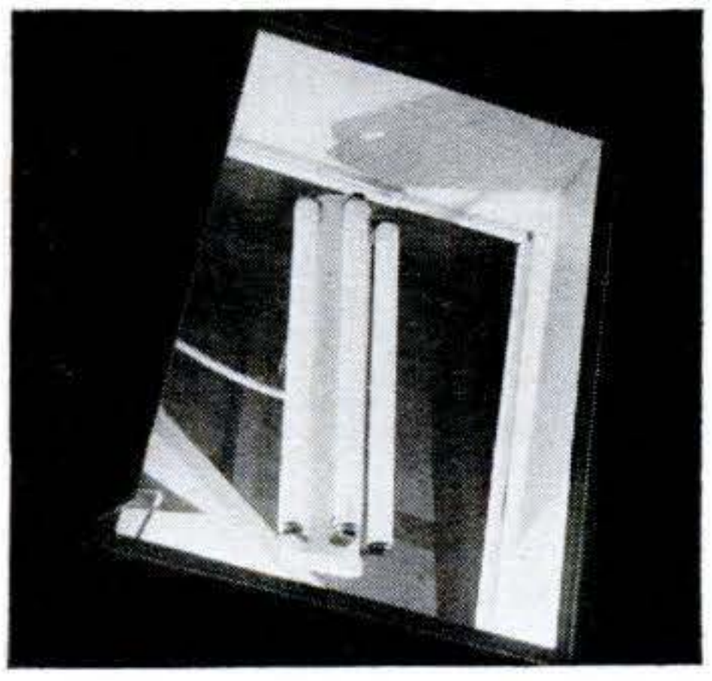
The best starting point is a trap door—technically a scuttle—in the upper-hall ceiling. If the scuttle is in the wrong place, or if it is the only means of access to the attic, better leave it alone and cut a new hole in the ceiling.

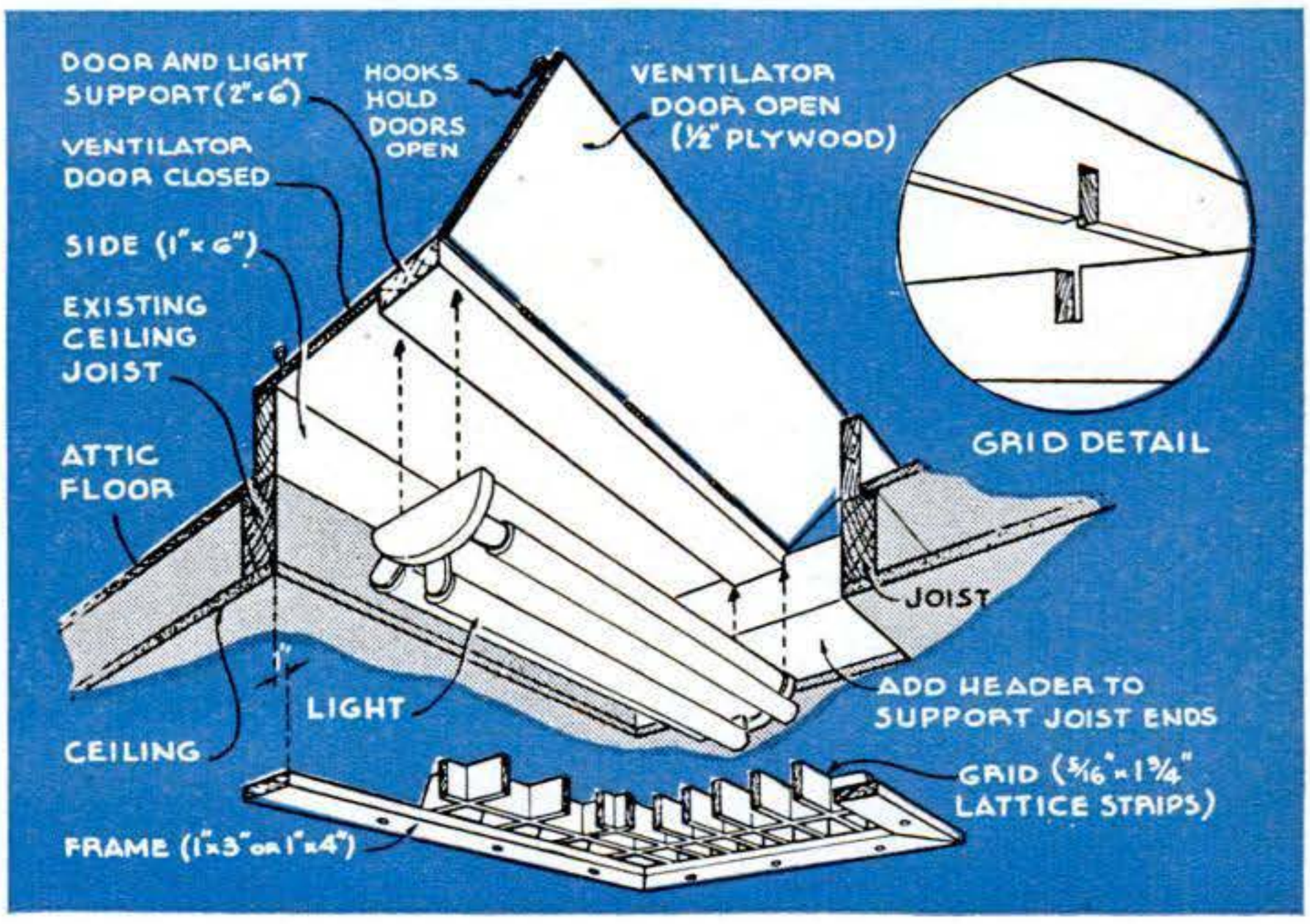
Before you cut a hole, sound out the location of ceiling joists and use them to frame the opening if possible. If you have a plaster ceiling, cut the outline of the hole with a chisel. Be sure to tie together the ends of any joists you cut by putting in headers as shown in the sketch.

Construction of the vent is similar whether you cut a hole or use a scuttle. First build a box of 1″ by 6″ stock around the top of the opening. Nail a 2″ by 6″ strip across the top center of the box to support a fluorescent light fixture and two ventilating doors. Hinge the doors so you can close off the vent in winter.

A lattice-strip grid of the type illustrated conceals the opening without cutting off either light or air. It clears the sides of the well about ¼″ all around and is held in place by a frame that is screwed to joists and headers from below.—*Edwin D. Thatcher, New York City.*

An inexpensive industrial-type fixture is used behind the concealing grid. If you have no electricity in the attic you may have to add a junction box and run BX up to the new light.





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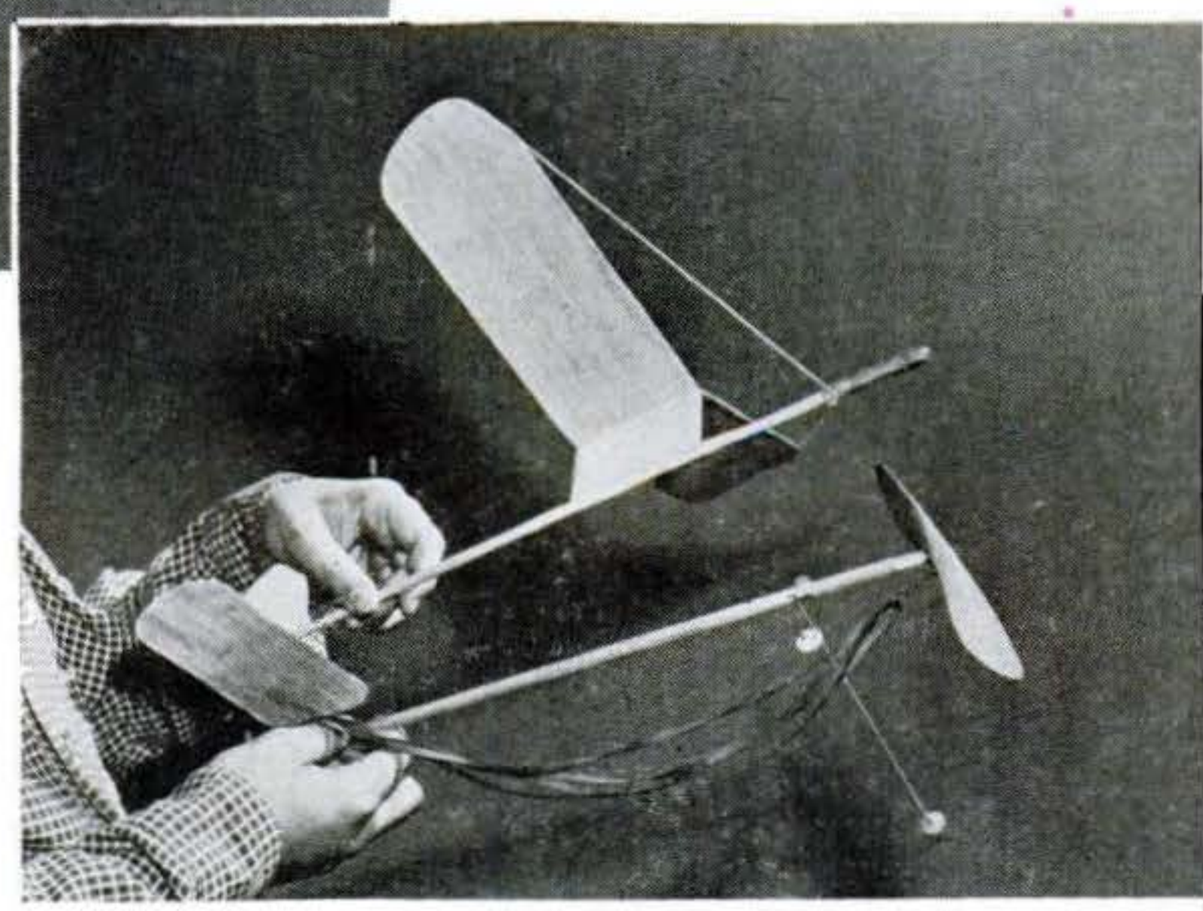
One way to get a glider up high is to attach a propeller and, when the craft hits its ceiling, let the prop unit drop off. That's what happens with this one. Relieved of extra weight, the glider loafs along on the breeze while the prop unit falls, usually without harm to itself.



Power Glider Drops Its Motor

By Paul Mueller

TAKING its cue from the droppable gas tank and the step rocket of space flight, this model is a combination of glider and power unit. A rubber-powered prop takes it aloft, but when the motor run is over, the power stick falls, leaving the glider free of its weight and drag so that duration flights may be obtained.

The glider fuselage has two notched metal fittings. Pins in two other fittings on the motor stick are held in the notches by the tension of the rubber motor, but drop out as the strands go slack.

Wing and tail. Cut the wing from 1/16" medium-weight, straight-grained balsa. Sand both surfaces smooth and round off the edges. Give the wing a coat of clear dope.

Now apply streaks of cement across the wing and pin it down over blocks to form the 1/4" undercamber. When this has set, cut it apart at the center and sand the cut ends so they will form a joint when each wing tip is raised 2 1/2". Glue the wing halves together at this dihedral angle and strengthen with a glue fillet. Cut the stabilizer and rudder from 1/20" sheet, sand smooth, and dope. No camber is required.

Fuselage and stick. Both the glider fuselage and the power stick are 1/8" by 1/4" pine or hard balsa. Taper one end of each as in the drawings, leaving the sections square to make fittings easier to attach. The prop bearing is bought ready-made. Bind it on tightly with thread and coat with cement. The special fittings are all made from tin-can stock, strips 1/4" wide being cut and bent as detailed. File the notches to slope downward for easy release of the motor stick.

Three of the fittings are attached with cement and thread. Wrap the motor stick

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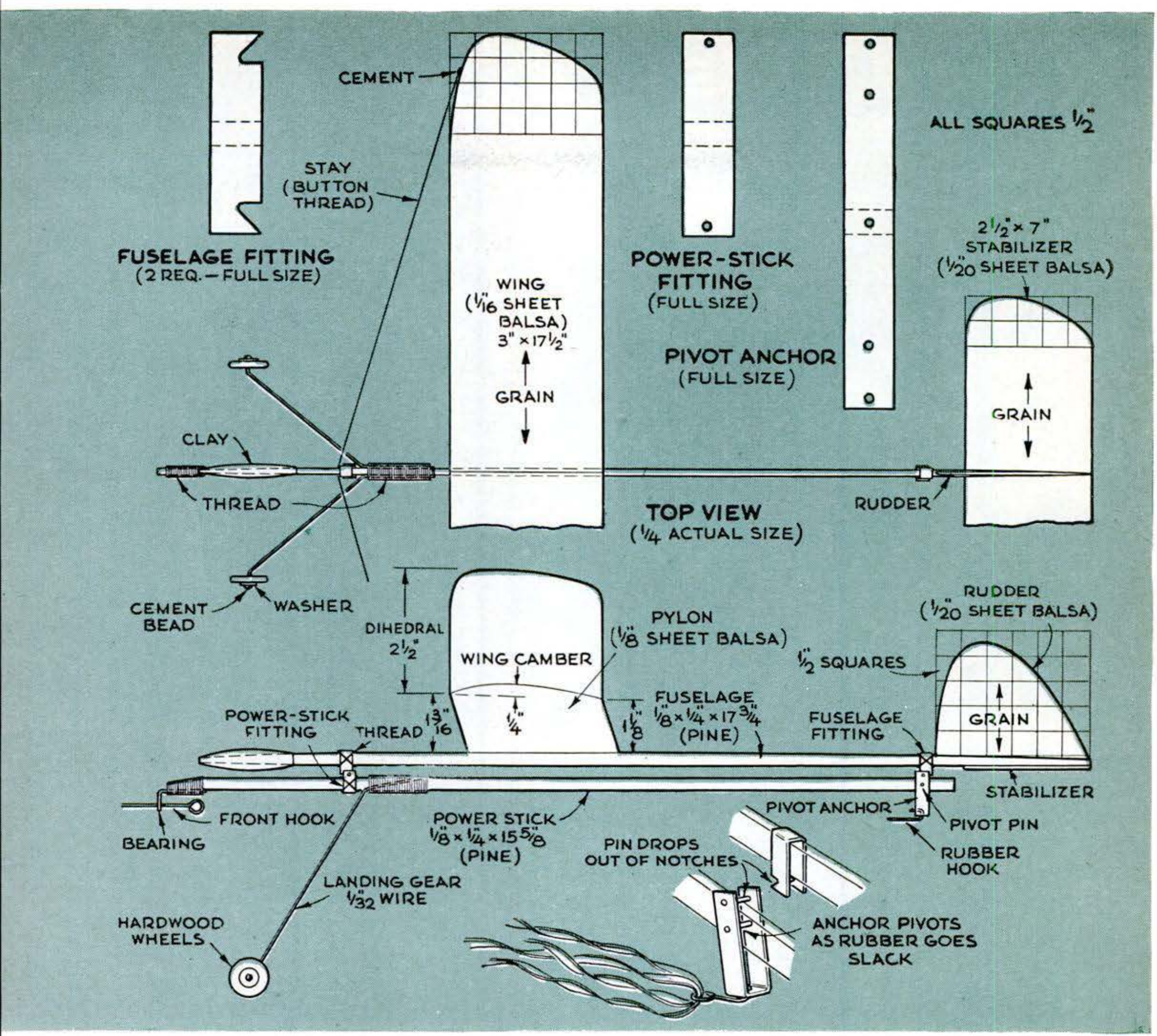

smoothly with thread where the pivoting motor anchor is to go, and coat the thread with cement. Insert a bit of 1/32″ wire as a pivot. Cement in ordinary pins, with the points cut off, to engage the notches in the other fittings.

Pylon. This wing mount is cemented on 5⅜″ from the front of the fuselage. Sand it front and back to an airfoil shape, and cut a V-shaped groove in the top edge to seat the wing, which should have about 1/16″ incidence or uplift at the leading edge. Cement on the wing and tail. Sight from the nose to align them.

For outdoor flying, it's advisable to rig stays from wing tip to wing tip, across the front fuselage fitting. This saves the wing edges. Use heavy button thread pulled taut.

Prop and wheels. A 6½″ prop flies the model shown. Bend the hook and sink it into the hub in the usual way. Insert the rear motor hook in a hole in the pivoted anchor. Four strands of 3/16″ rubber power the original, but you may want to experiment to suit your own model.

Although not used for landing, the wheels enable the model to make ground take-offs. Shape the wire landing gear and bind on tightly. Hardwood wheels can be held on with a bead of cement over a washer.

Test flight. Add clay to the nose of the glider until you get a slow, flat glide. Then wind the motor 50 turns, attach it to the glider, and try it. If the model stalls, warp down the trailing edge of the stabilizer. Adjust for a steady climb.

The original climbs to the left in a tight circle until the power unit drops. The glider descends in a slow right circle. Flights average one to one and a half minutes. END

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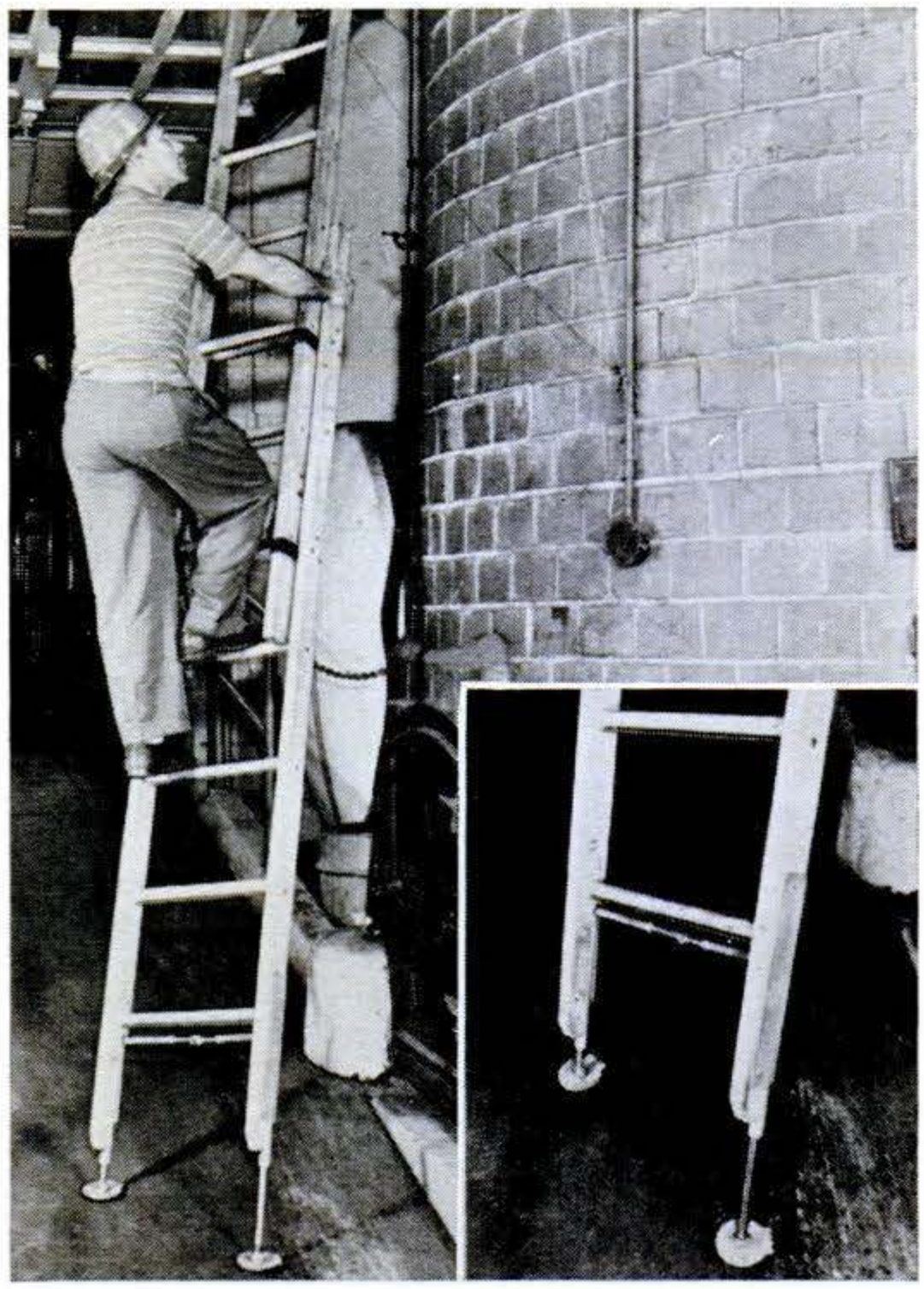
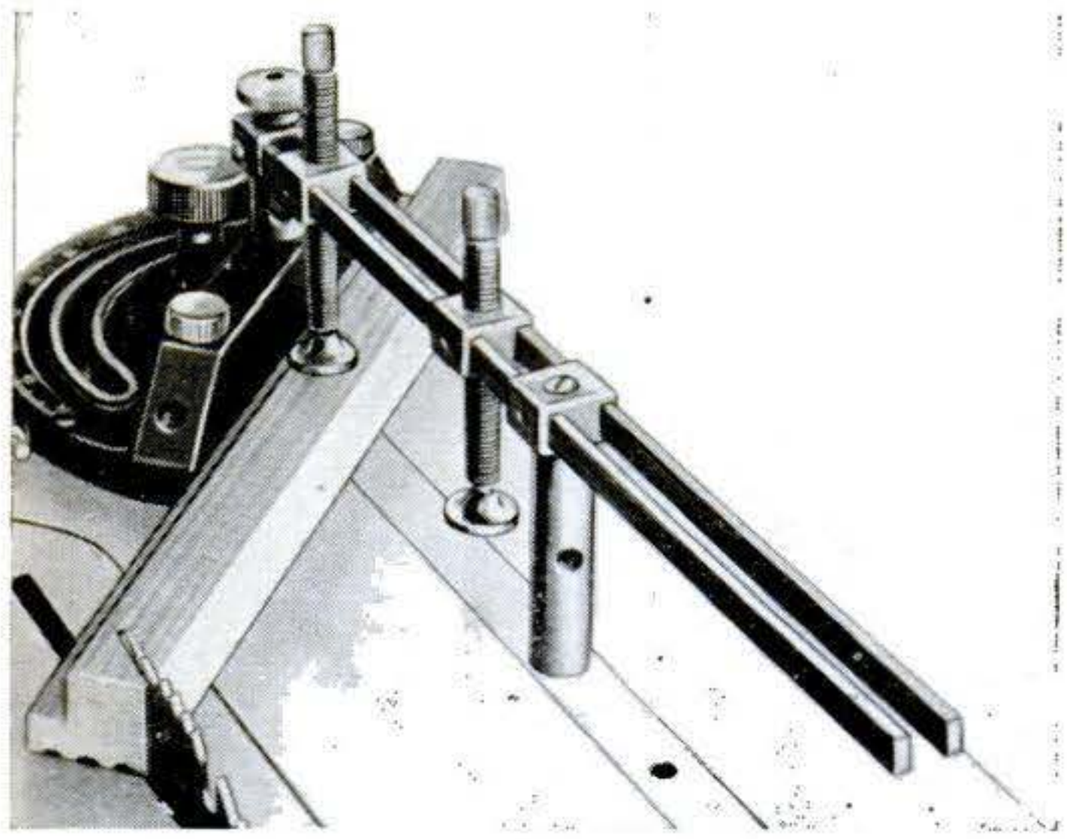
New Tools

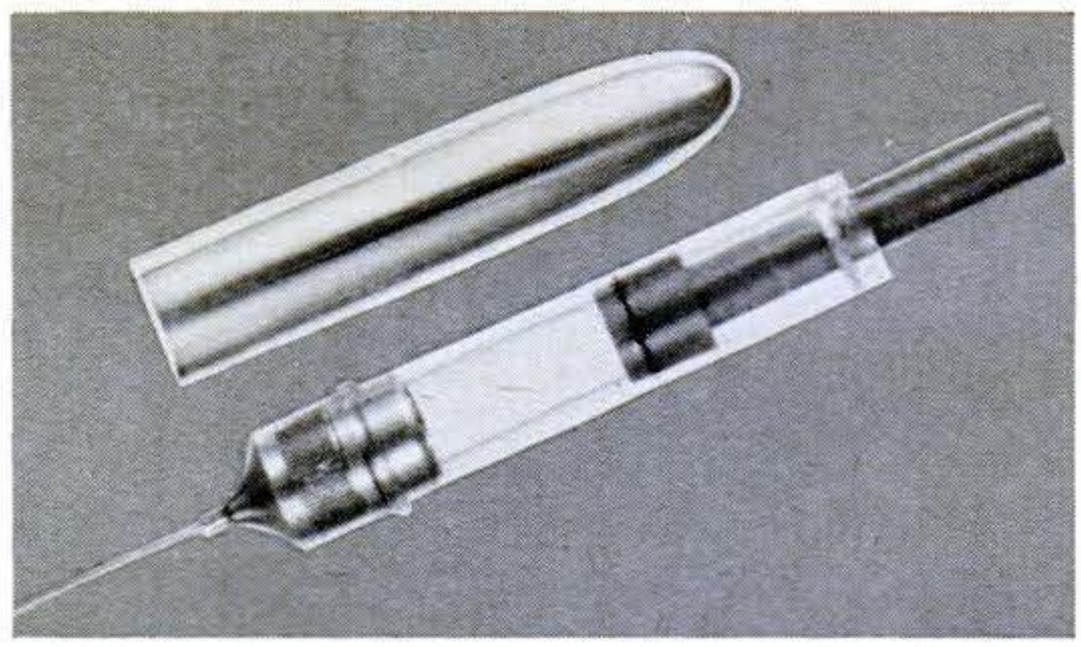
"Dowser" Locates Studs. This plastic tool is held with its base against a plaster or wallboard wall while you pound the wall above it with the side of your fist. If you are testing between two studs, the small bearing ball will be jarred away from the large ball. If you hold the tool over a stud, there will be little if any movement of the small ball. *Ford Products, Tuckahoe, N. Y. $2.*



Hydraulic Stabilizer Levels Ladders. This adjustable "shoe" attachment makes ladders sure-footed even on a sloping surface. Vertical tubes house plungers that are connected by horizontal telescoping tubes leading to a valve. Above the plungers, the unit is filled with oil. When the valve is open and one leg moves up to adjust itself to a difference in level, the other leg moves down. Closing valve locks the legs. It fits ladders from 17″ to 29″ wide. *Mine Safety Appliances Co., Pittsburgh.*



Miter-Gauge Attachment Holds Work. This attachment consists of an overhead bracket and two clamps that firmly hold work at the preset angle. Delta makes it for use on miter gauges for its circular saws, bandsaws, shapers, and abrasive finishing machines. *Rockwell Mfg. Co., Minneapolis.*



Pen-Size Grease Gun for Small Parts. For model makers and watchmakers, this grease gun uses a 1″ hypodermic needle .049″ thick. Pressing plunger controls the amount of grease ejected. A cap protects the needle when the gun is not in use. *Gaunt Industries, Chicago. $1.*

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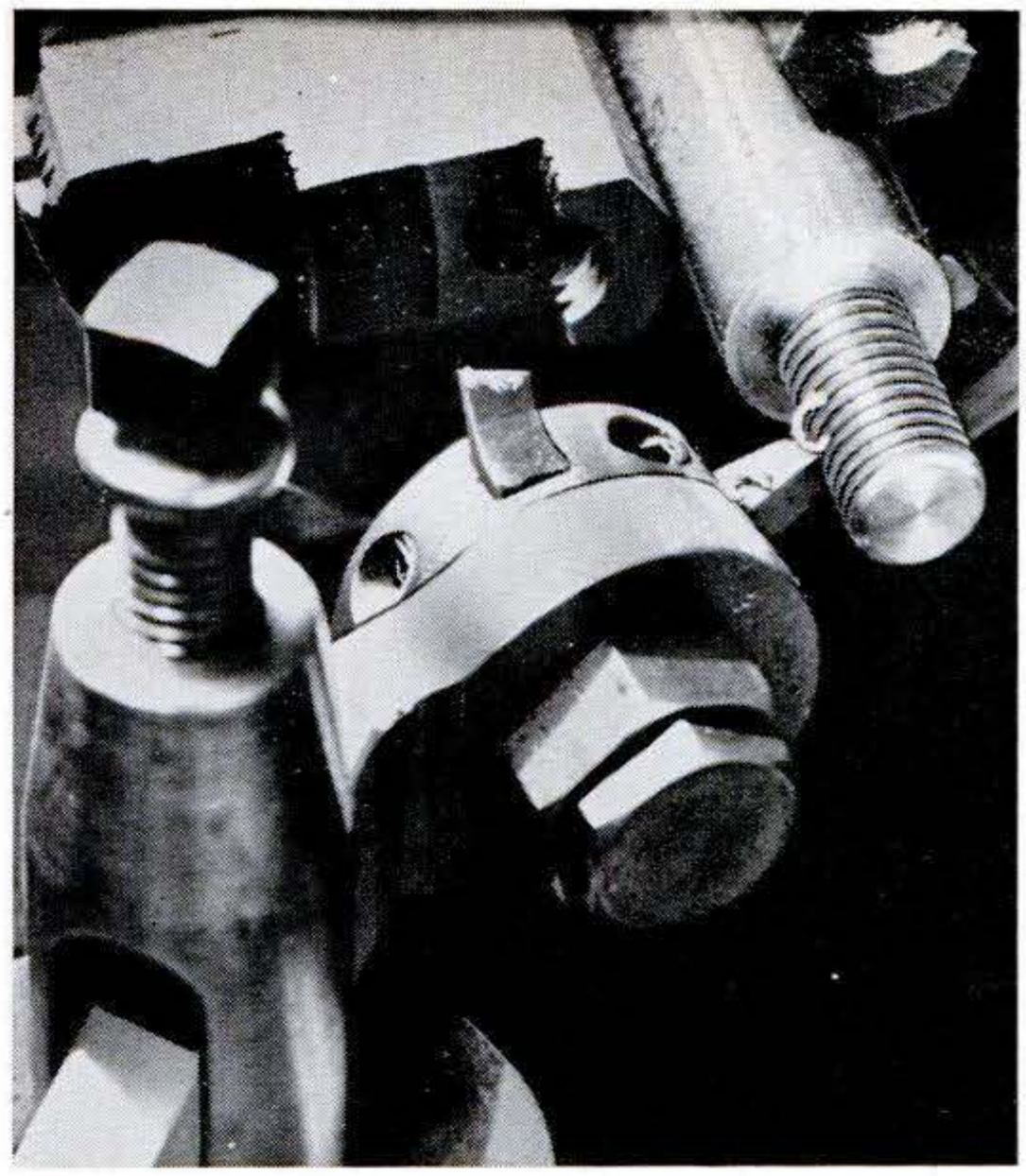
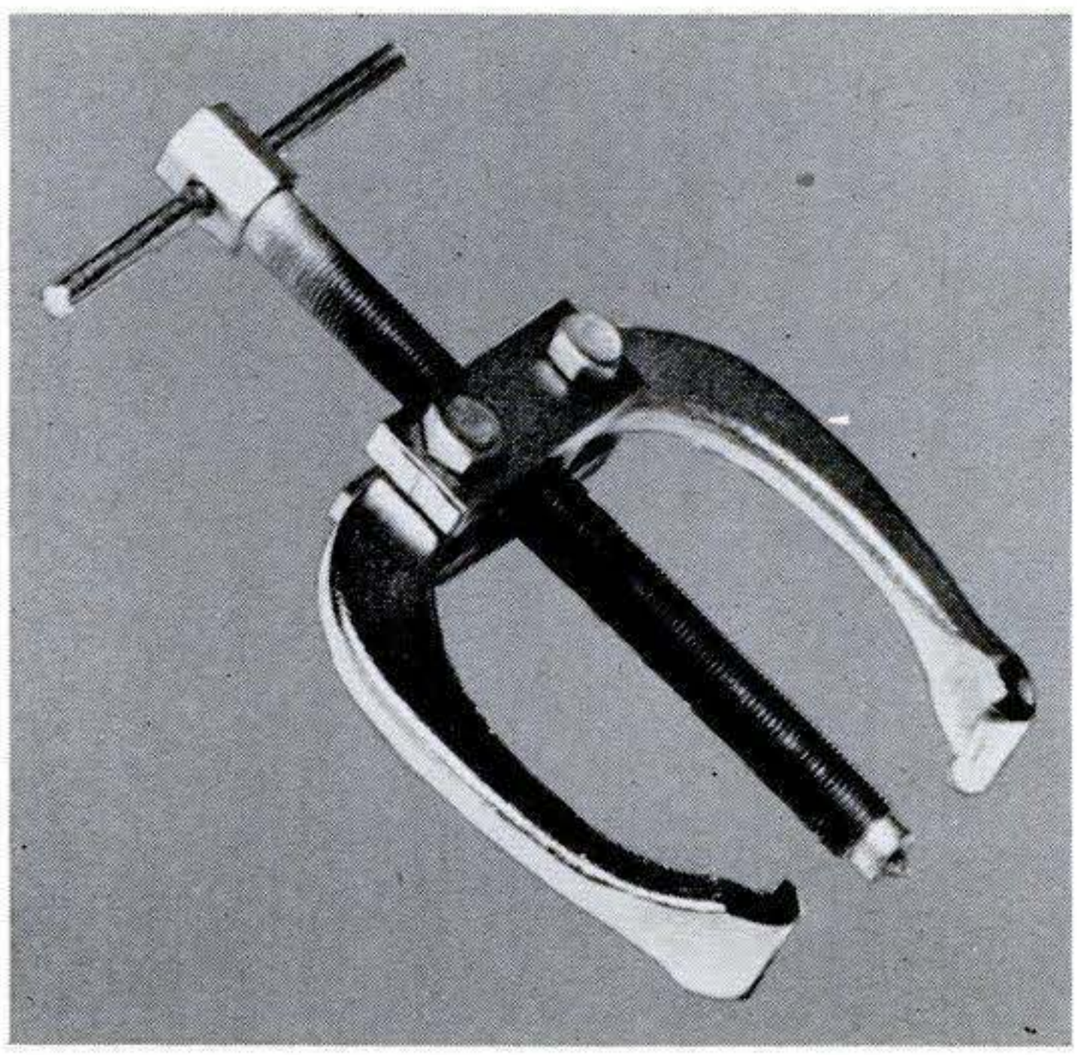
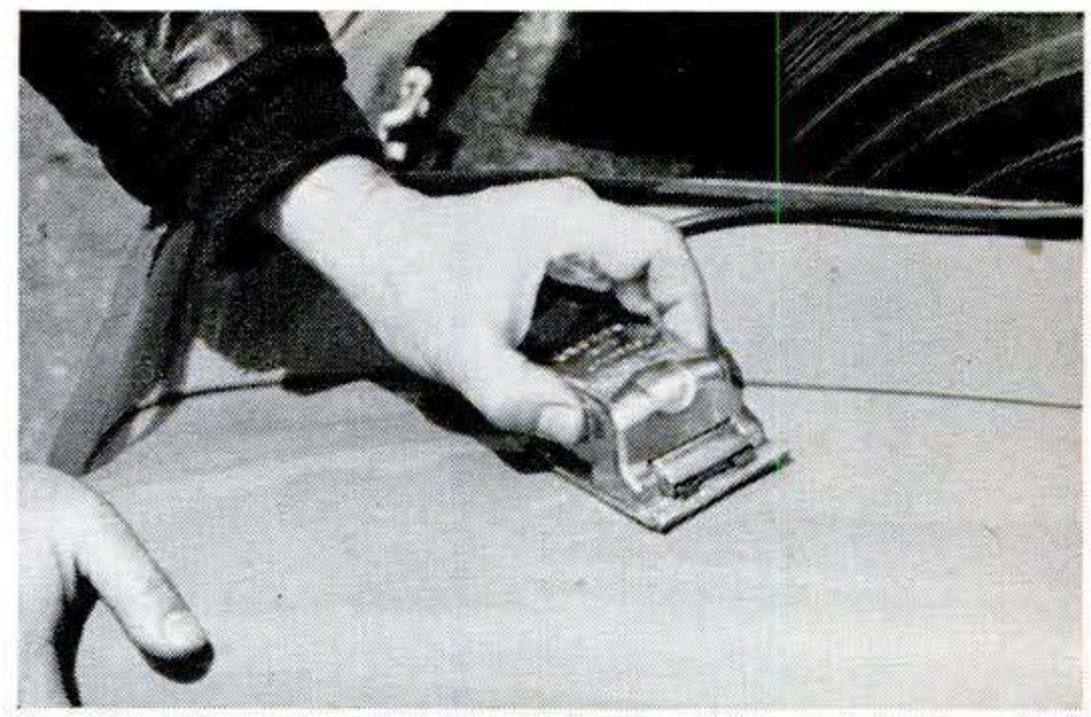


Holder Takes Four Tool Bits. Any of four cutting tools can be brought into position by indexing the vertical turret on this tool holder. An internal pin at the end of the shank locks the turret in position. The tool holder does not have to be reset when bits are changed. Designed for 5/16″ tool bits the holder is available with left-hand, right-hand, or straight shanks. *Wilgus Manufacturing Co., Los Angeles. $28.75.*

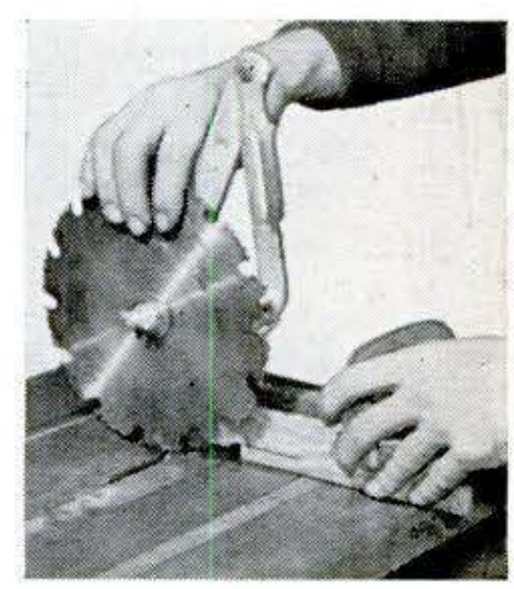


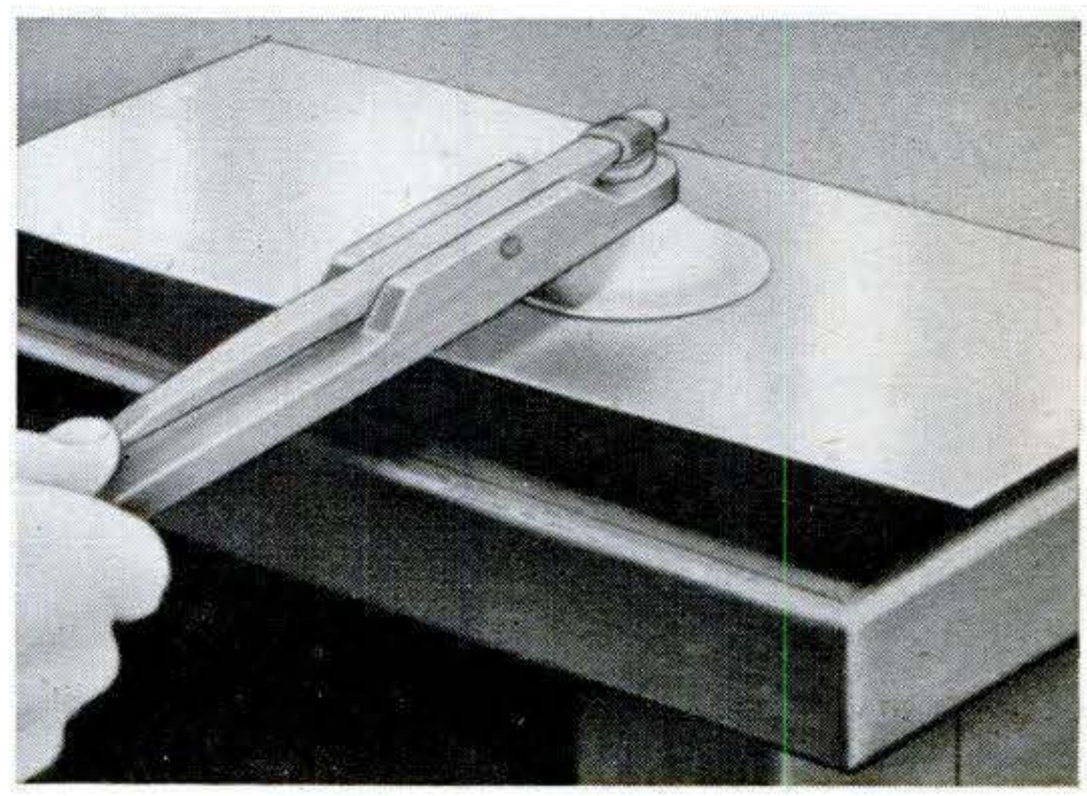
Gear Puller for Home Shop. Intended for the home craftsman, this tool removes stubborn pulleys and gears without damaging them or their shafts. It has a diameter capacity of 5½″ and will reach 3″ in from the end of a shaft. *Armstrong-Bray and Company, Chicago. $3.60.*



Auto-Engine Compression Runs Sander. A compressor, air tank, or the compression of your car engine will power the little vibrating sander above. It's designed to remove rust spots and scratches from auto bodies before touching them up. For use with a car engine, an adapter is screwed in the head in place of a spark plug. *Dupli-Color Products Company, Chicago. Sander, $3.98; adapter, $2.98.*

Fixture Converts Saw to Sharpener. With this attachment you can use your circular saw to sharpen and gum its own blades. The fixture takes a blade up to 12″ in diameter, holding it while an abrasive wheel on the arbor dresses each tooth. *Quick-Way Saw Co., Corning, N. Y.*





Vacuum Lifter Feeds Punch Press. Designed to prevent finger and hand injuries, this feeder is used to position blanks in a punch press. A light blow fixes the vacuum cup on the blank. Depressing a thumb lever releases vacuum and drops the blank. *Industrial Products Co., Philadelphia.*

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Rack Your Tools for Better Service

Whether you store tools by method or madness makes a whale of a difference in the ease—and quality—of your work.

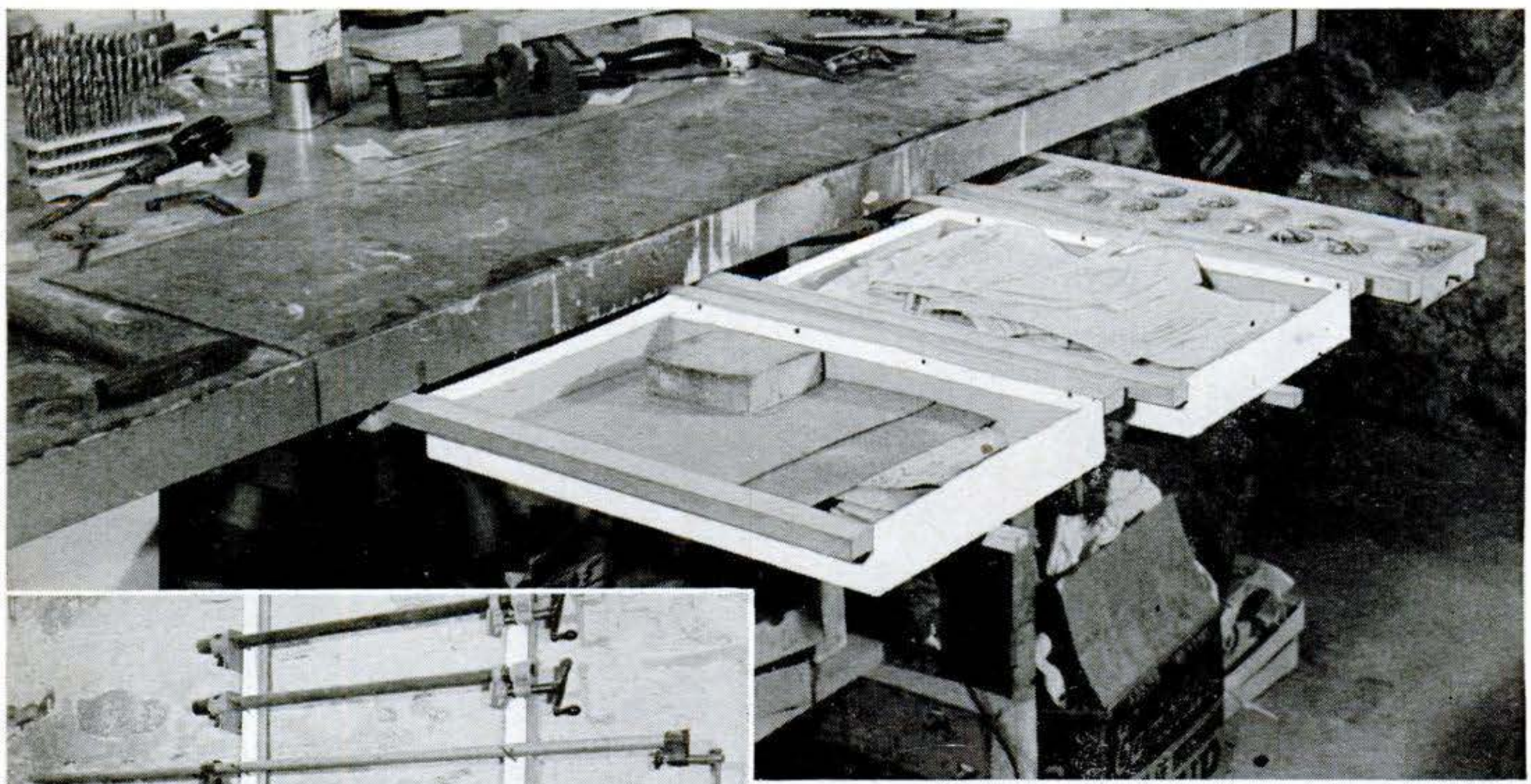
By Robert Gorman

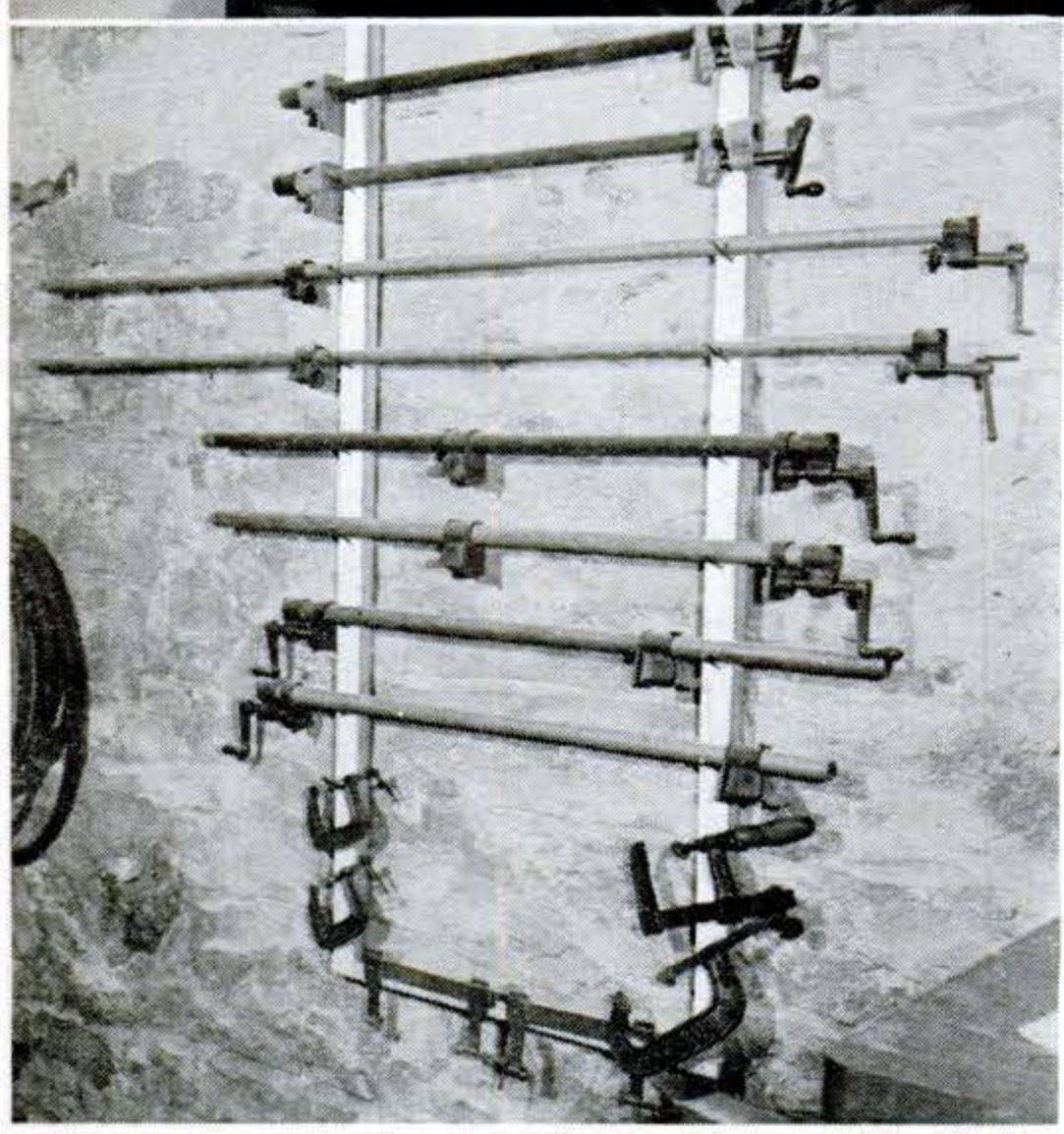
DO YOU sometimes use the wrong tool because the right one is hiding? If you're not getting full mileage out of your workshop, maybe you've forgotten the first rule of the professional: There's a right place for every tool.

The box at the right gives pointers on tool storage, but it isn't meant as a blueprint. A good plan for your shop has to take into account the tools and equipment you have, the space you can spread them in, the number of people who use the shop, and the use each one makes of it.

The photos below and on the next three pages show some tool-storage tricks used by PS contributors Walter E. Burton, Edwin M. Love, Herbert Pfister, and Doris Aller. Can you make their ideas serve you?

Where to Store Them: Put Dead Space to Use





Tools and parts should be kept near the area where they're used. Space under and around a bench is often used wastefully or else overlooked. The flat storage drawers above hold sandpaper, drawings, and other small, light objects. Two drawers are cardboard gift boxes. Square wood strips tacked along the box edges ride in under-the-bench guides made of L-shaped molding. Third drawer (at right) is a block of wood bored full of 2″ blind holes that hold a variety of screws, nails, small parts.

Rack for glue clamps (left) shows how you can put rough stone walls to use. The rack is made of two-by-two's nailed to the joists overhead so they hang down in front of the wall. A crosspiece at the bottom joins them. Clamps rest on angled nails driven into the strips.

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Tool Storage Do's and Don'ts

DO

Keep common tools handiest. Screwdrivers, pliers, and hammers deserve front-row seats in any shop.

Group tools used on the same job. Tin snips and soldering iron belong together—but not necessarily with woodworking tools.

Keep accessories handy to the tool they're used with. Attachments for lathe, saw, and other power tools belong close to home.

Identify your "quality" tools. A reminder tag or band of paint may keep you from opening a packing case with your best chisel.

Keep track of borrowed tools. Hang a tag on the vacant hook even when your neighbor says "I'll bring it back in an hour."

Store little-used tools where they won't gather dust, especially precision tools like micrometers or dial indicators.

Leave room for additions. When you plan your layout, allow space in the right places for the tools you're going to buy.

DON'T

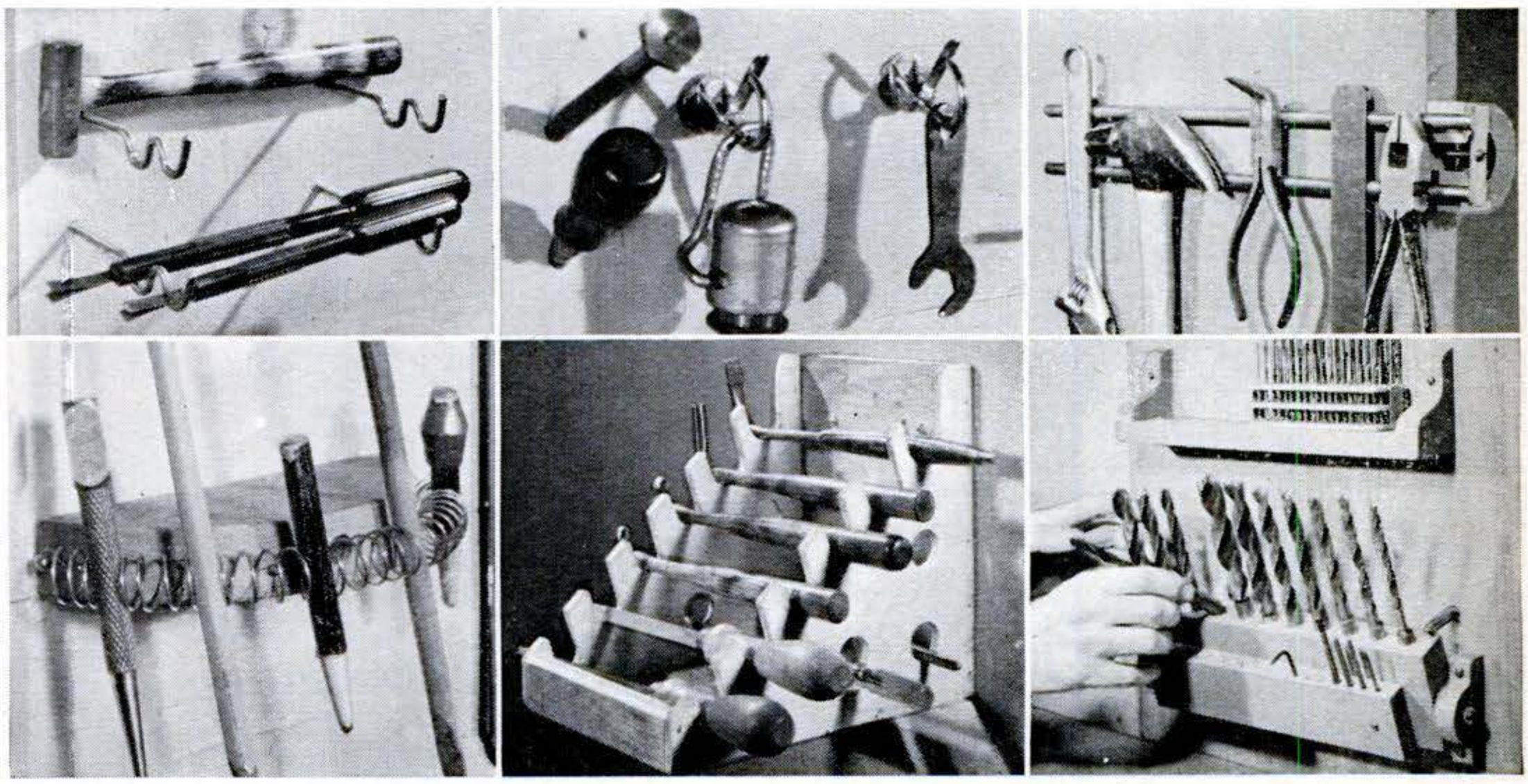
Store cutting tools where they can get nicked or dulled. It takes only a little care to keep blades sharp.

Leave pointed tools where they can snag hands or clothes. Never put sharp-edged items in front of other tools.

Leave fine tools where they can be jostled or dropped. Sharp blows ruin some tools. They belong in drawers, not draped on pegs.

Store electric tools so their cords can come uncoiled. Wires that dangle on the floor get frayed, plugs get crushed.

How to Hang Them: Holders You Can Buy or Make



Hardware-store items made for other purposes solve many tool-hanging problems. Double curtain-rod hooks, for example, make fine supports for many long, slender tools. Spring-closing cup hooks (top center) resist vibration, keep tools from being knocked off accidentally. Note also the downward-sloping holes that take punches, small screwdrivers, and the like.

A homemade magnet rack (upper right) is convenient for some tools. This type uses two strong horseshoe magnets and a pair of iron rods. Magnets are placed on the edges of a board, flush with its face, and fastened with aluminum strips and brass screws. Like poles are in contact with each rod. Small nails under rods keep them from shifting.

A coil spring stretched around a wooden half circle (lower left) holds pencils, glue spreaders, or punches, and allows you to remove or replace them instantly.

If you have to store some tools behind others, put the rear ones on "steps." It's easy to reach any tool in the plywood rack (bottom center). Two plywood triangles were tacked together and holes were drilled and sawed in both pieces. The sides were glued and nailed to two spacer boards.

The tilting tool rack (bottom right) keeps drills flat against the wall, but allows them to be pulled out when they're needed. A rack like this, used below an overhanging shelf, is good for tools that should be stored sharp side up. It keeps points and edges covered and protects you from accidental cuts.

Turn the page, please, for more tool-storage ideas.

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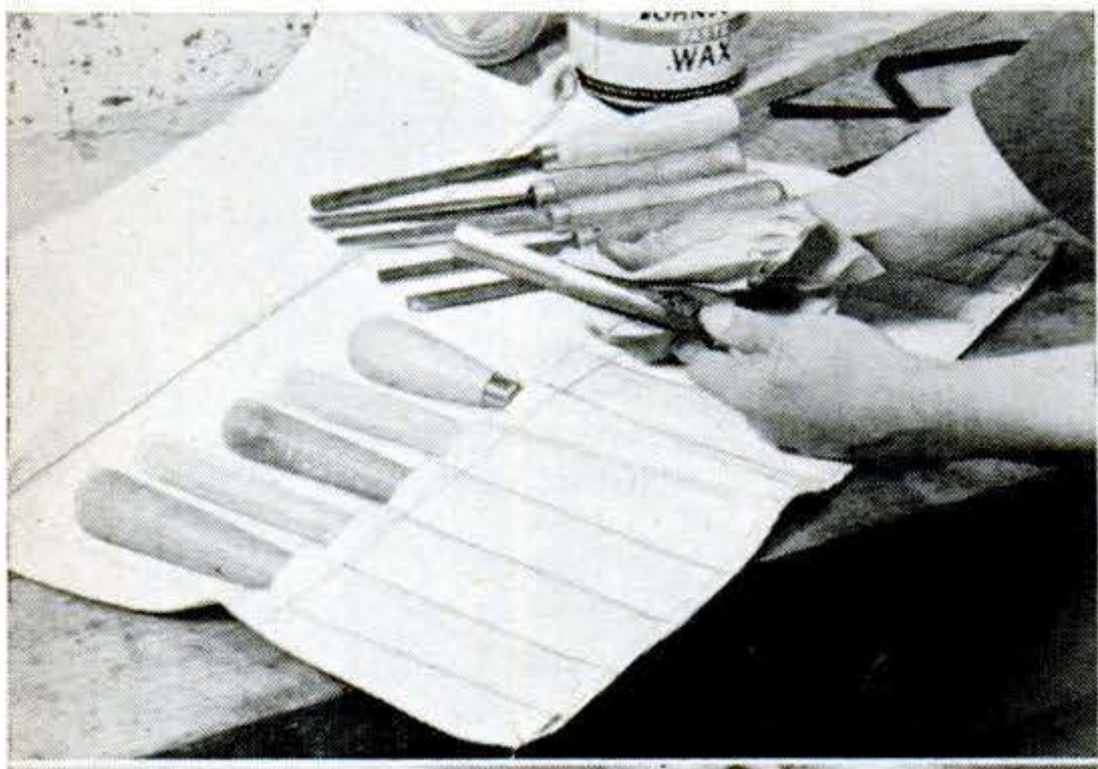
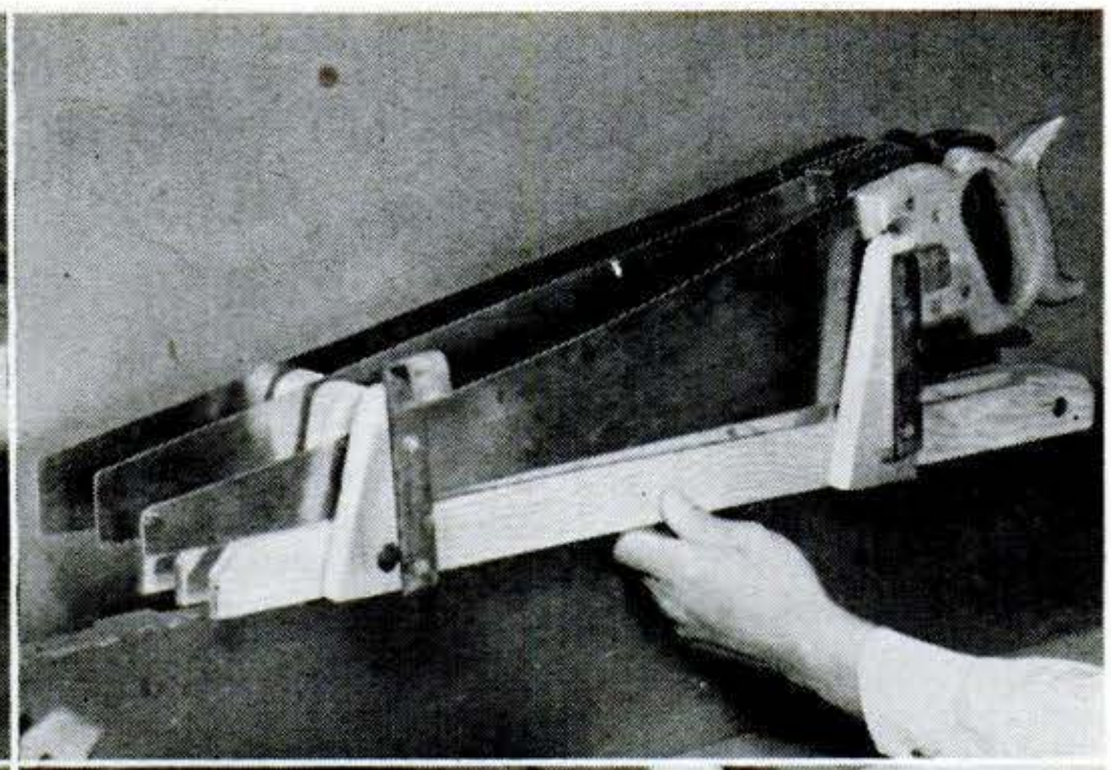
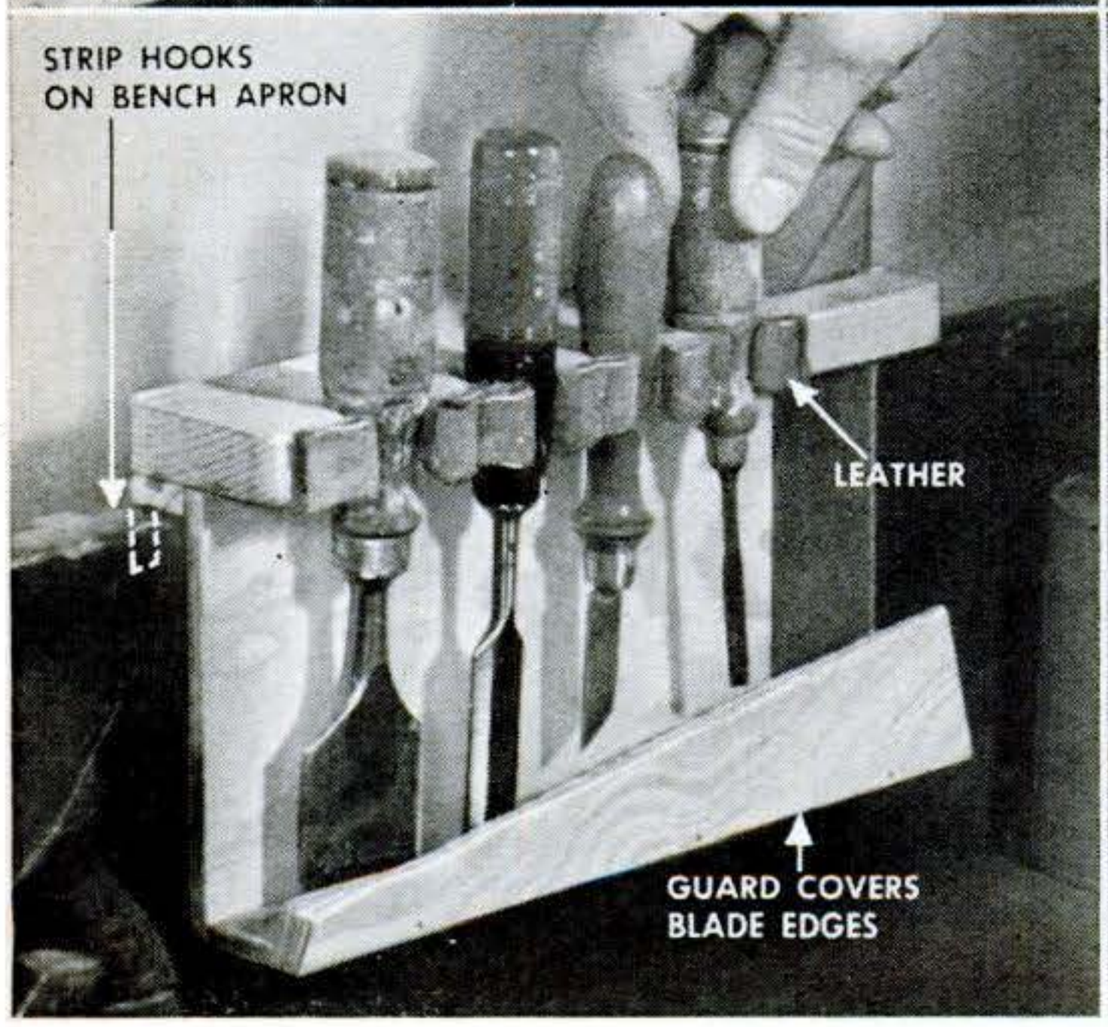
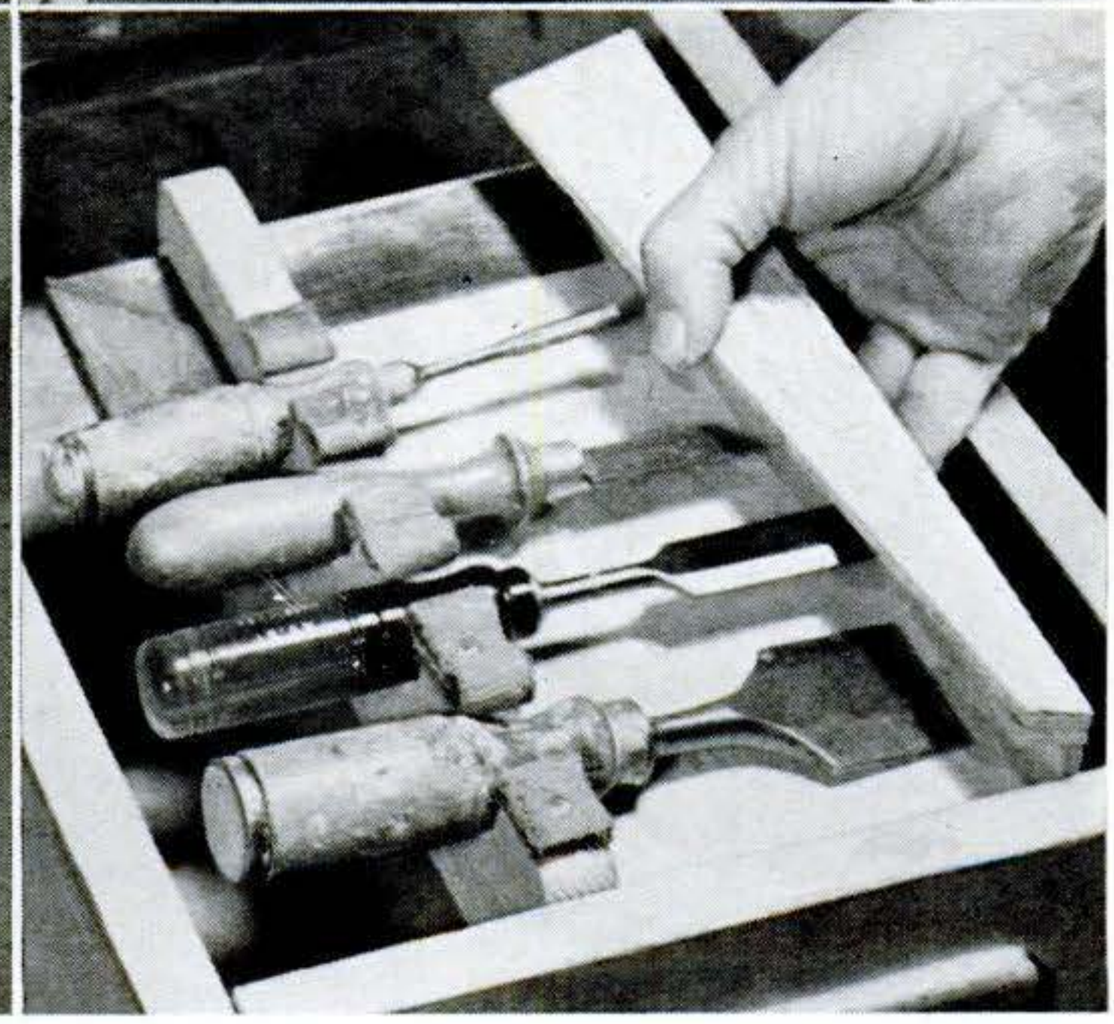
These Toolholders Keep Dust Out









Though exposed racks are handy, many workers prefer to keep some tools under cover. These holders let you hang tools where and when you need them, then store them when they're not in use. The canvas roll holds a set of fine woodcarving gouges. Grommets at the corners allow the roll to be hung above the bench. When the job is over, their owner lightly waxes the gouges and puts them away.

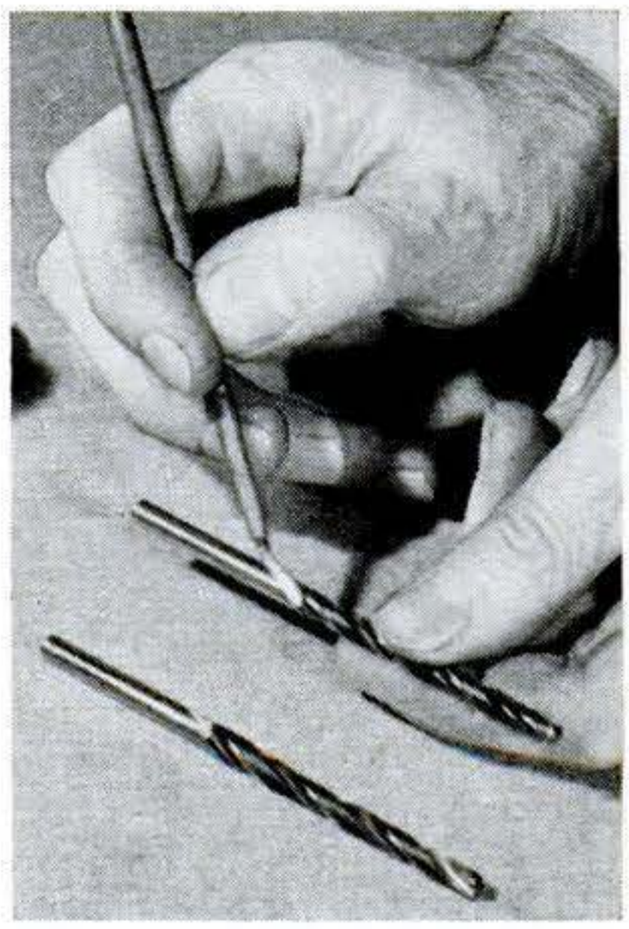
The saw rack (at upper right) hangs behind the bench on two scrap-metal clips. The uprights that support the saw handles are made long enough to keep all but the front teeth from resting on the rack.

The plywood chisel rack can be hooked on the workbench apron or stored flat in a drawer. Leather bumpers hold the chisels securely, yet allow them to be snapped in and out easily. The tapered guard strip is made just wide enough to cover the blade edges.

Markings Are a Help in Storage and Selection

An outline on the backboard of a rack shows where a tool belongs. The cardboard outlines (left) are sometimes better than those painted on the board because they can be changed easily when tools are moved. These are clamped between the holders and backboard. They could be thumbtacked behind different types of holders. Either way they can be relocated in a jiffy.

It's often helpful to identify the quality or condition of a tool or part. High-speed and carbon drills look alike, but you'll have no trouble telling them apart if you brush a bit of lacquer or enamel into the flutes as shown at right. Wash grease off before you apply the color.



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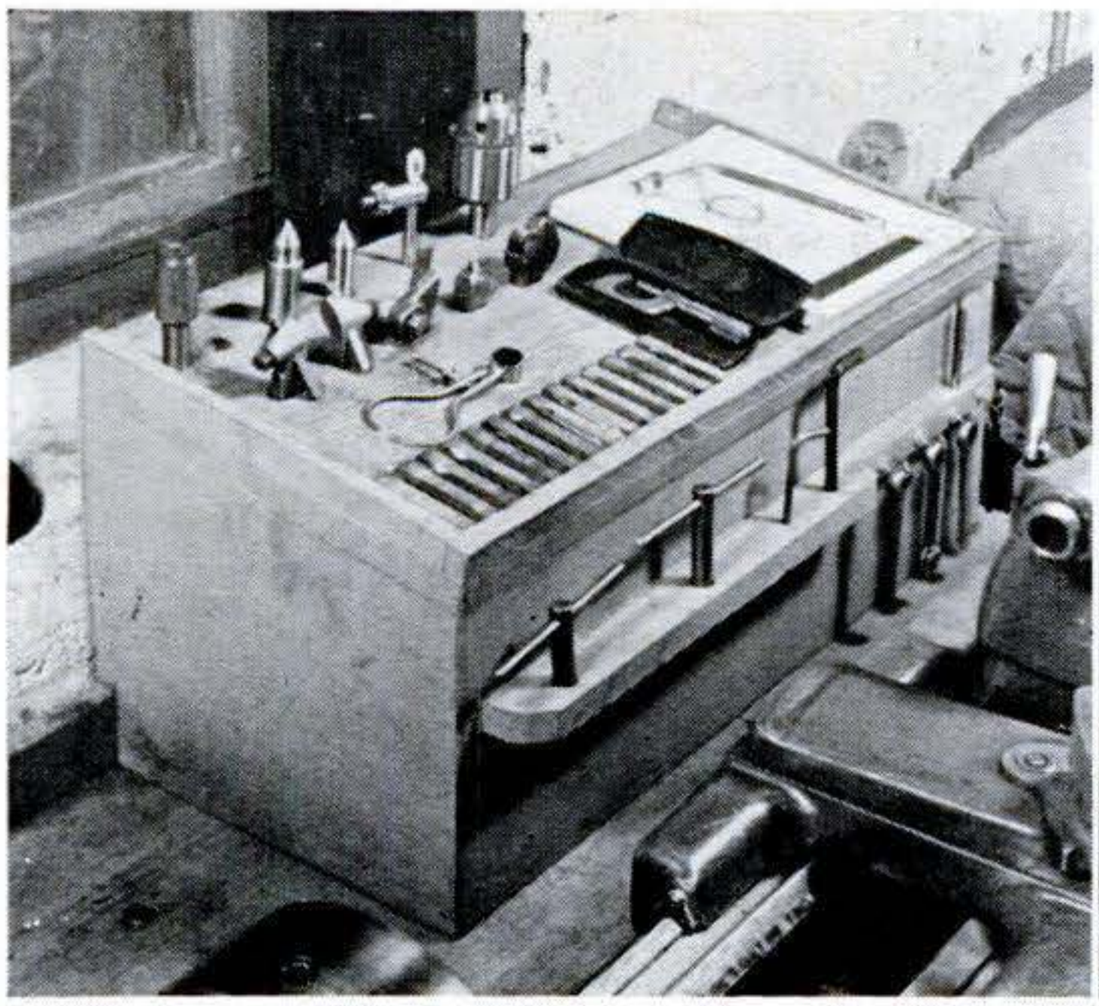
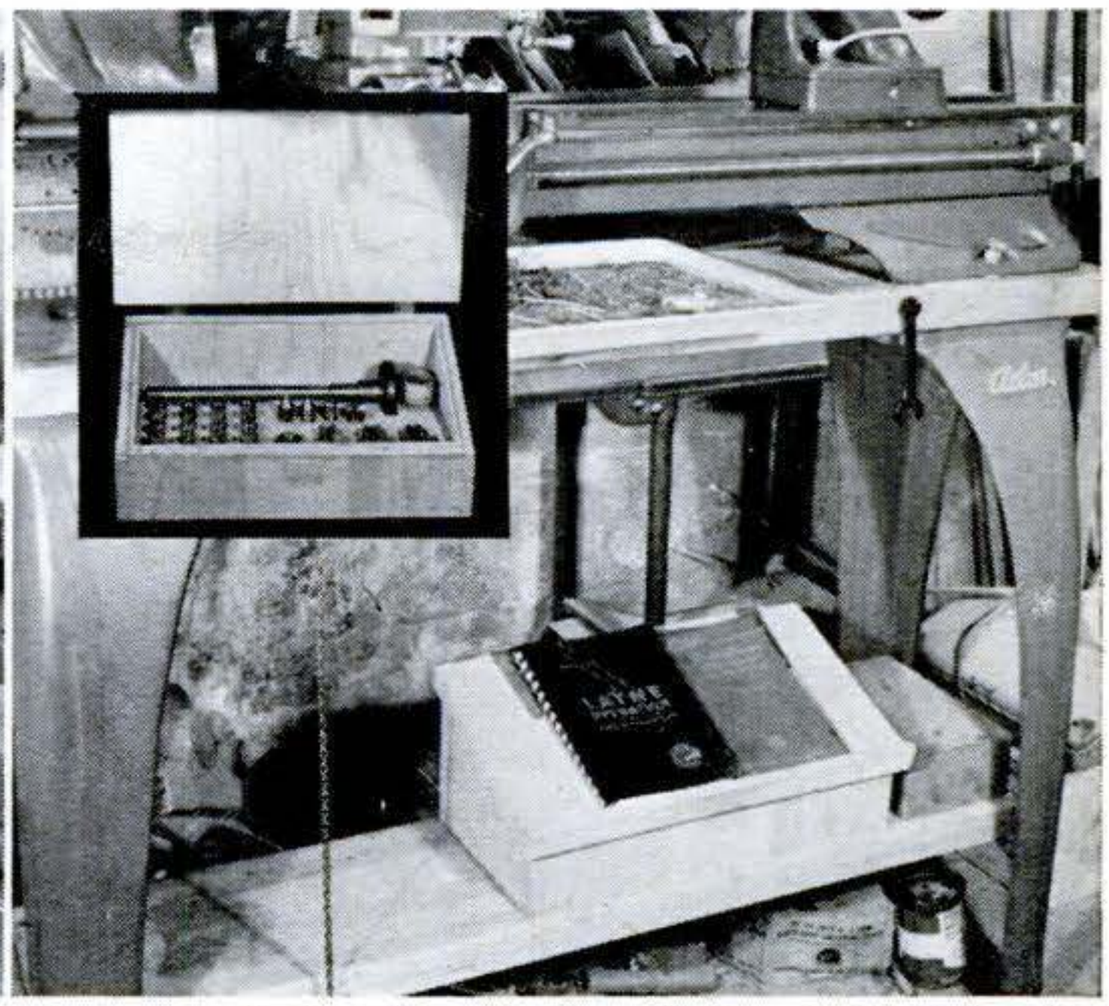
Keep Accessories Near the Tool They're Used With

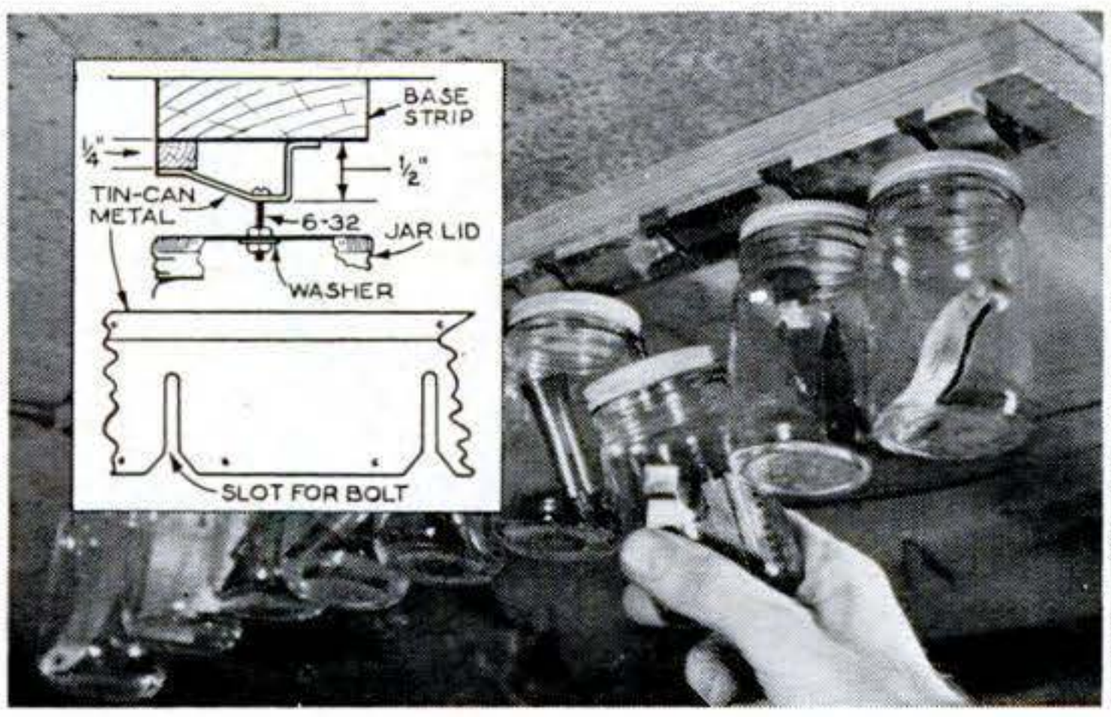




Power tools, especially lathes, aren't complete without a lot of bits and pieces. You can speed your work and make it easier by keeping attachments near the tool. The raised, sloping-top box (left above) occupies what would be waste space behind the lathe bed. Chucks, centers, keys, and the like fit into holes drilled in the top; cutters are lined up along the frame; a velvet eyeglass case holds a micrometer.

A more elaborate box, ideal for collets, is pictured in the inset (right). A dust cover doubles as an easel for handbooks or work prints.

Special Tools Deserve Special Holders

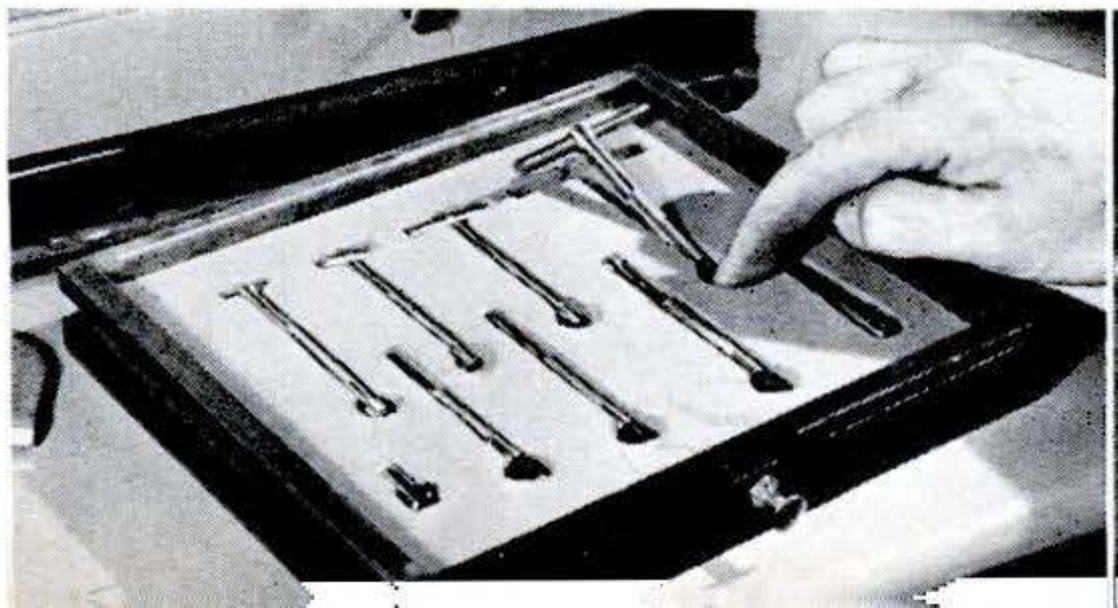


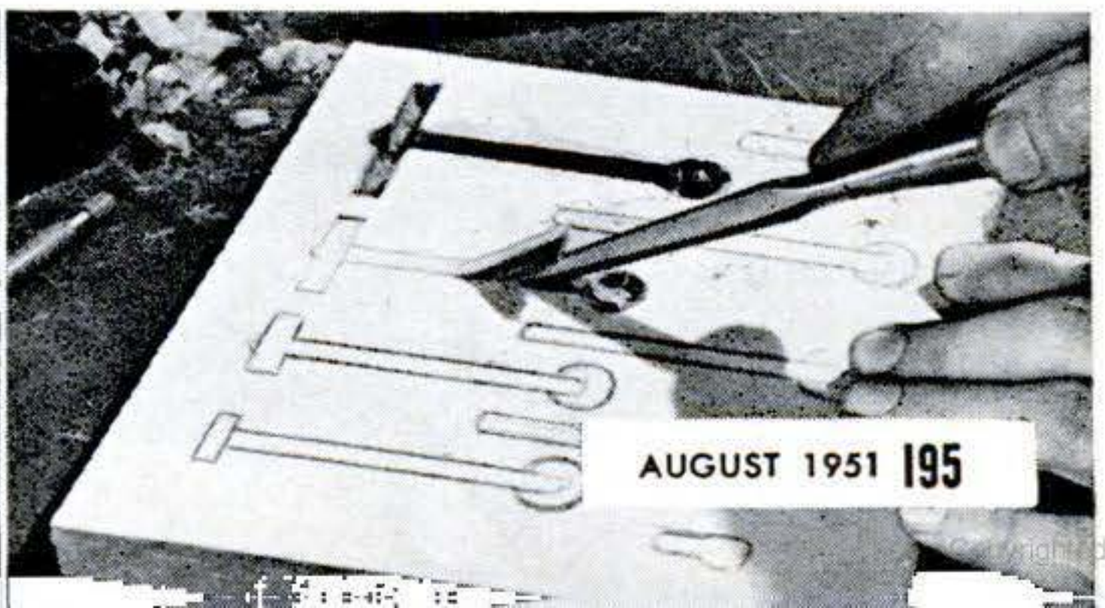
Dust is a nuisance, but moisture is an enemy. This rack, used with a suitable drying agent, combats both, and protects your fine tools. It's made from powdered-coffee jars and a couple of tin cans. The rack is mounted on the shop ceiling. Inset (at left above) shows construction of the slotted holders. Screws in jar lids slide in the slots.

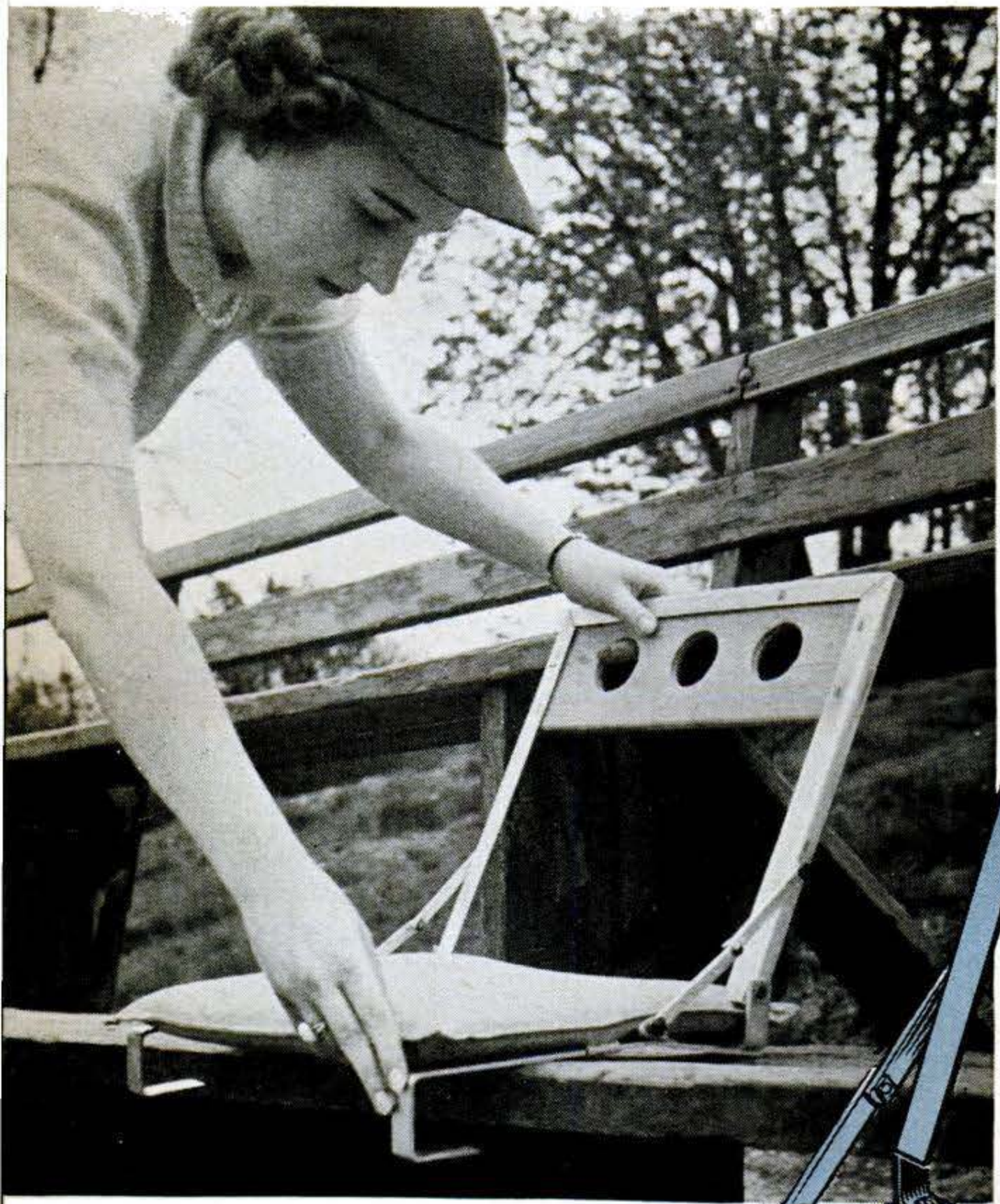
To keep tools dry, seal in a moisture-eliminating agent such as silica gel or calcium chloride. Or make your own by scorching brown paper or uncooked rice. Silica gel is best but most expensive. You may be able to buy some in surplus. If it's been exposed to air, restore drying powers by heating for a few hours in an *open* oven. Put the gel in small cloth bags or punched metal containers, such as the bouillon-cube tins at right, above.

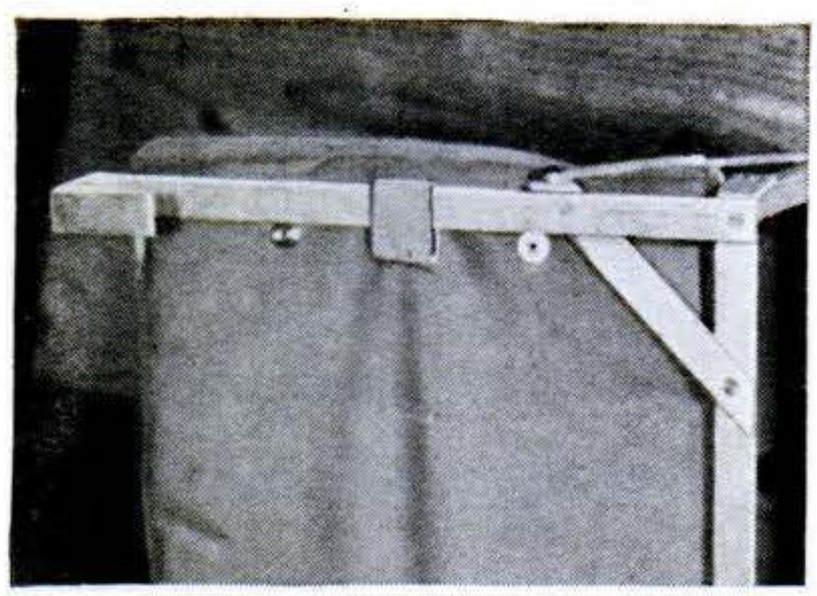
You can keep tool drawers more orderly—and protect tools better—by using fitted storage boards. This drawer holds a set of machinist's telescoping gauges.

Cut a sheet of ½" insulating board to fit the drawer. If extra thickness is needed for bigger tools, glue two or more sheets together. Trace the tool outlines and cut the recesses with a sharp knife and chisels. Make one end deeper for the tilt-up effect. Lacquer the cut parts to prevent fraying. In damp weather or places, oil steel tools lightly. END

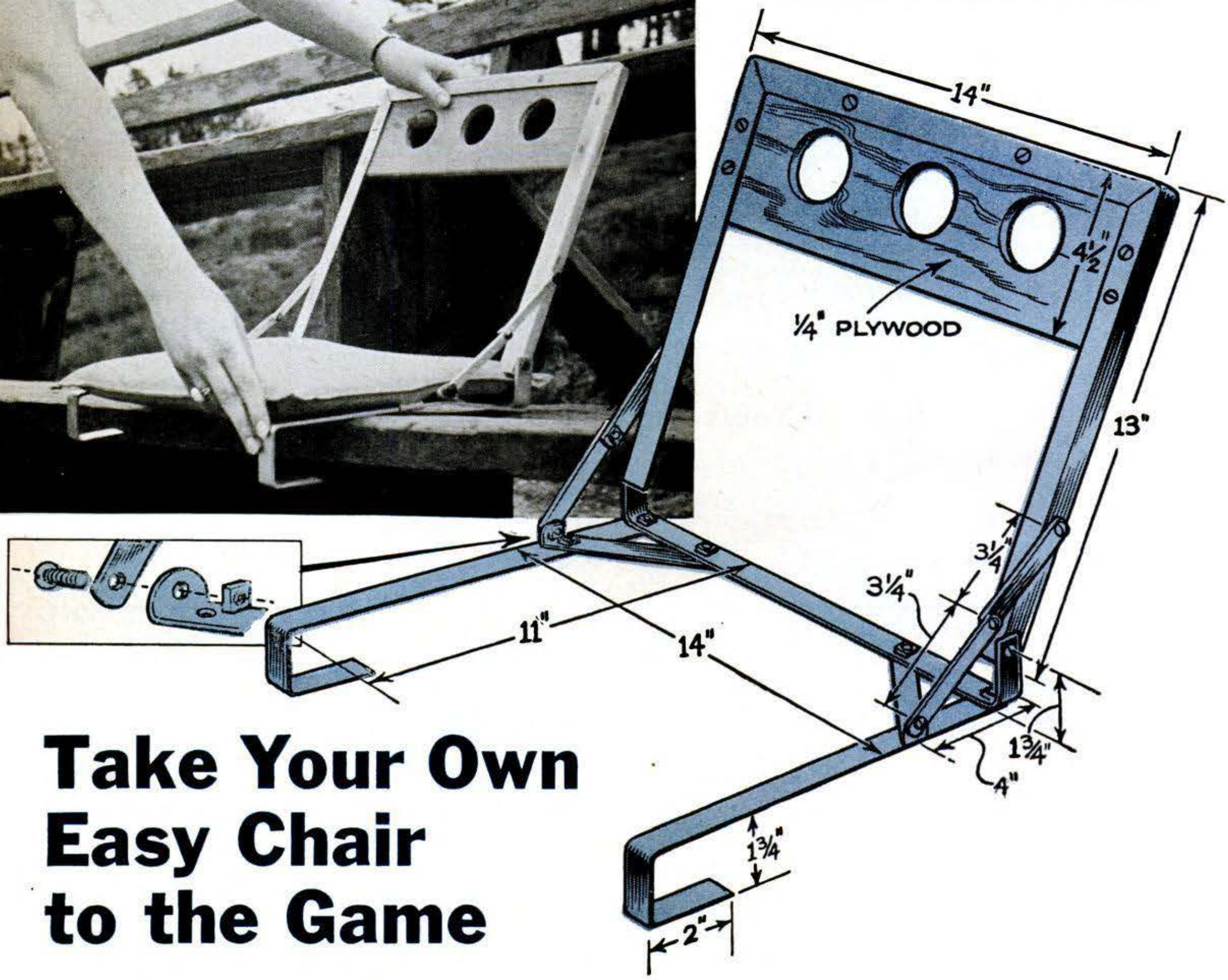








Web straps sewn to each side of cushion hold it on the framework.



Take Your Own Easy Chair to the Game

You'll have the most comfortable seat in the stadium when you've built this folding, lightweight, cushioned chair. ***By John Rogers***

ANY game is more fun to watch if you're comfortable. And that's what this stadium chair does—guarantees you an easy seat no matter where you're sitting in the stadium.

It folds into a compact, 2¼-lb. package, yet it's strong and rigid. Building it is simple. Bending, sawing, and bolting the aluminum frame require only a few hand tools.

What you'll need:

- 65″ of ⅛″ by ¾″ aluminum strap.
- 45″ of ⅝″ by ¾″ aluminum angle.
- 16″ of ⅛″ by ⅜″ aluminum strap.
- 10-24 bolts, nuts, and a scrap of plywood.

Figures allow a little extra for waste.

Shaping the back. Clamp the angle strip in a vise and notch it with a hacksaw, as shown in a photo at the top of the opposite page. Then, with the ⅝″ side in the vise,

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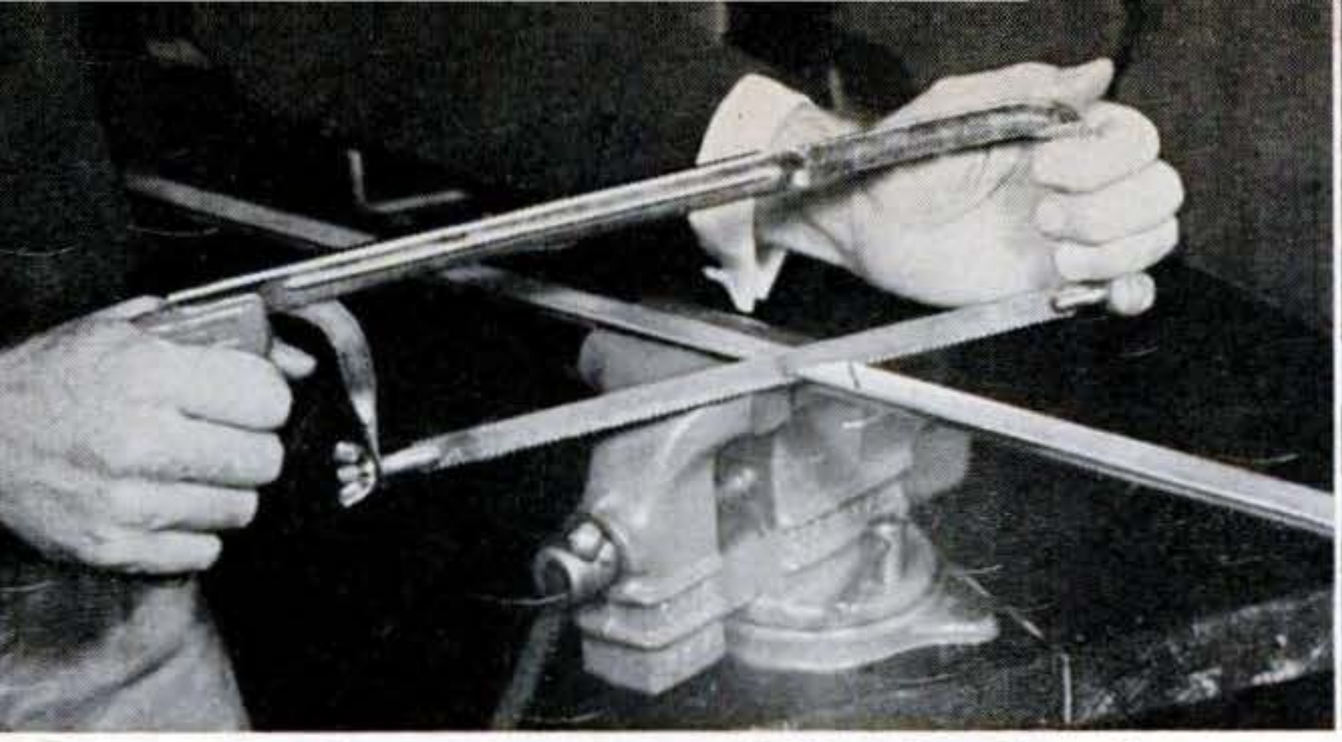
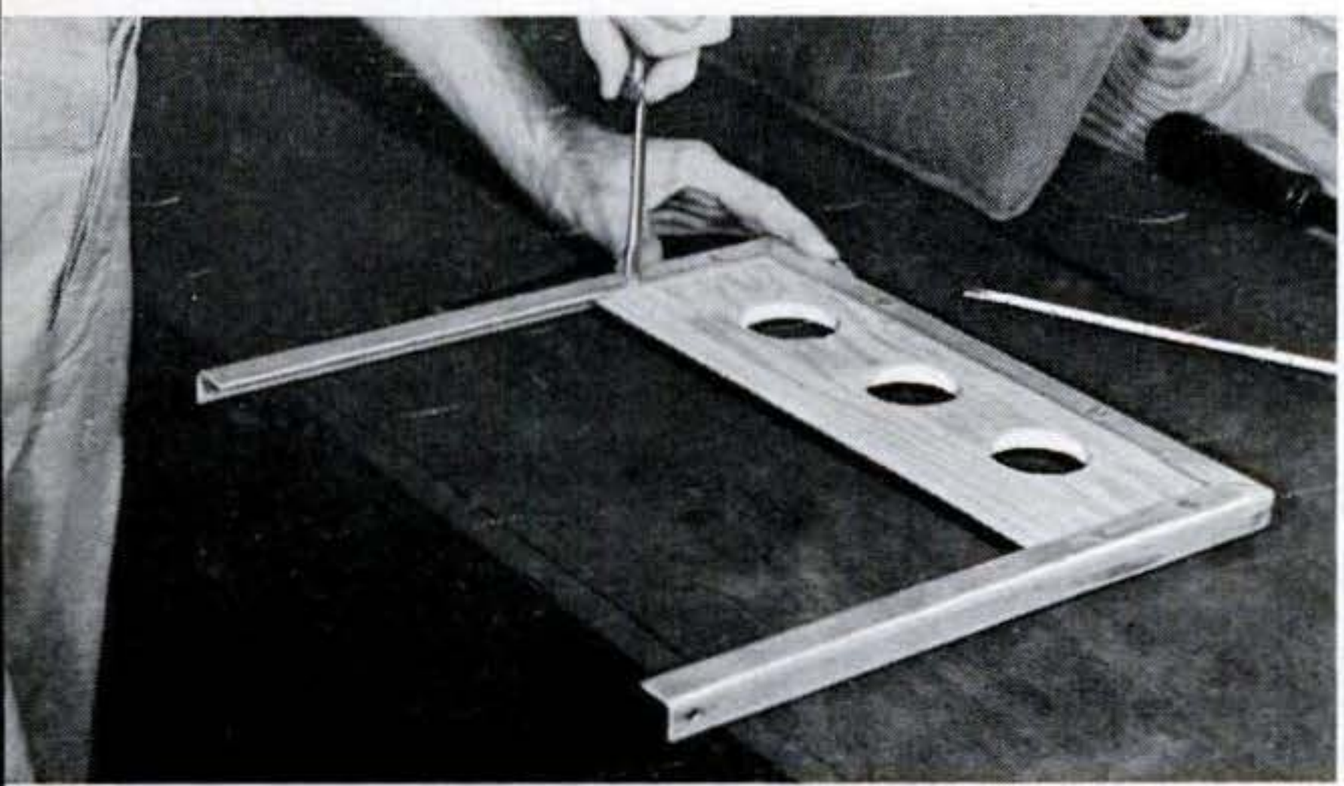
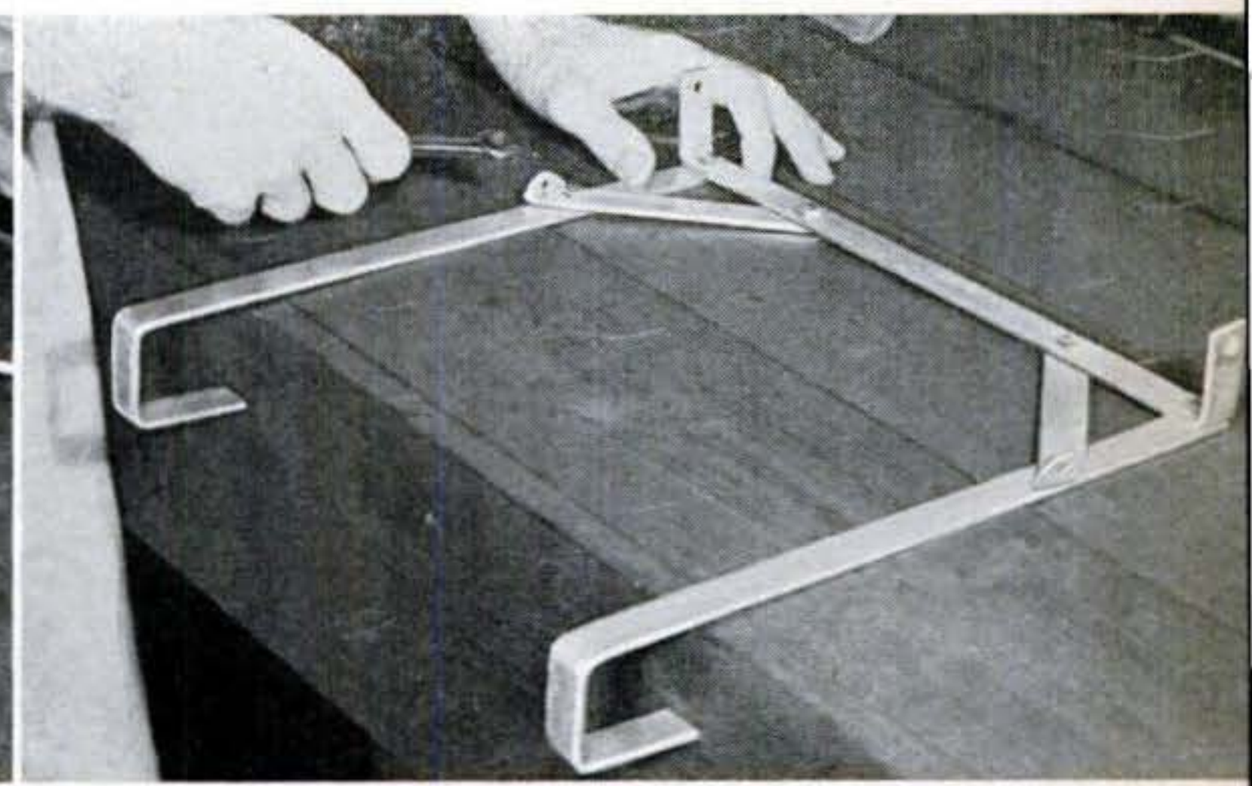


Notches are cut out of ¾" side of angle strip at points where it is to be bent 90°. Hacksaw the cuts at 45° to the edge of the strip.

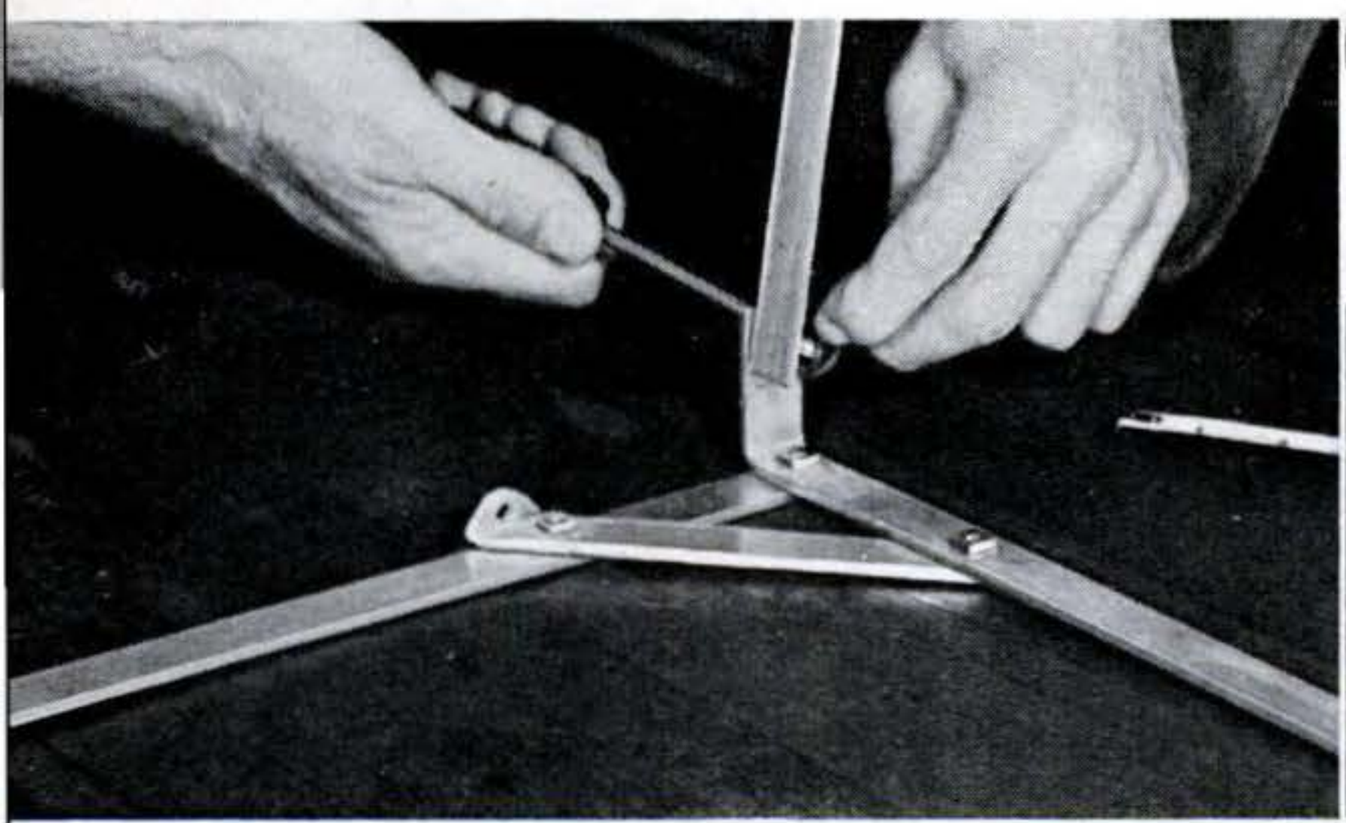
All aluminum parts can easily be bent to shape. Clamp parts in a vise and bend them with light taps of a hammer, as shown in photo above.



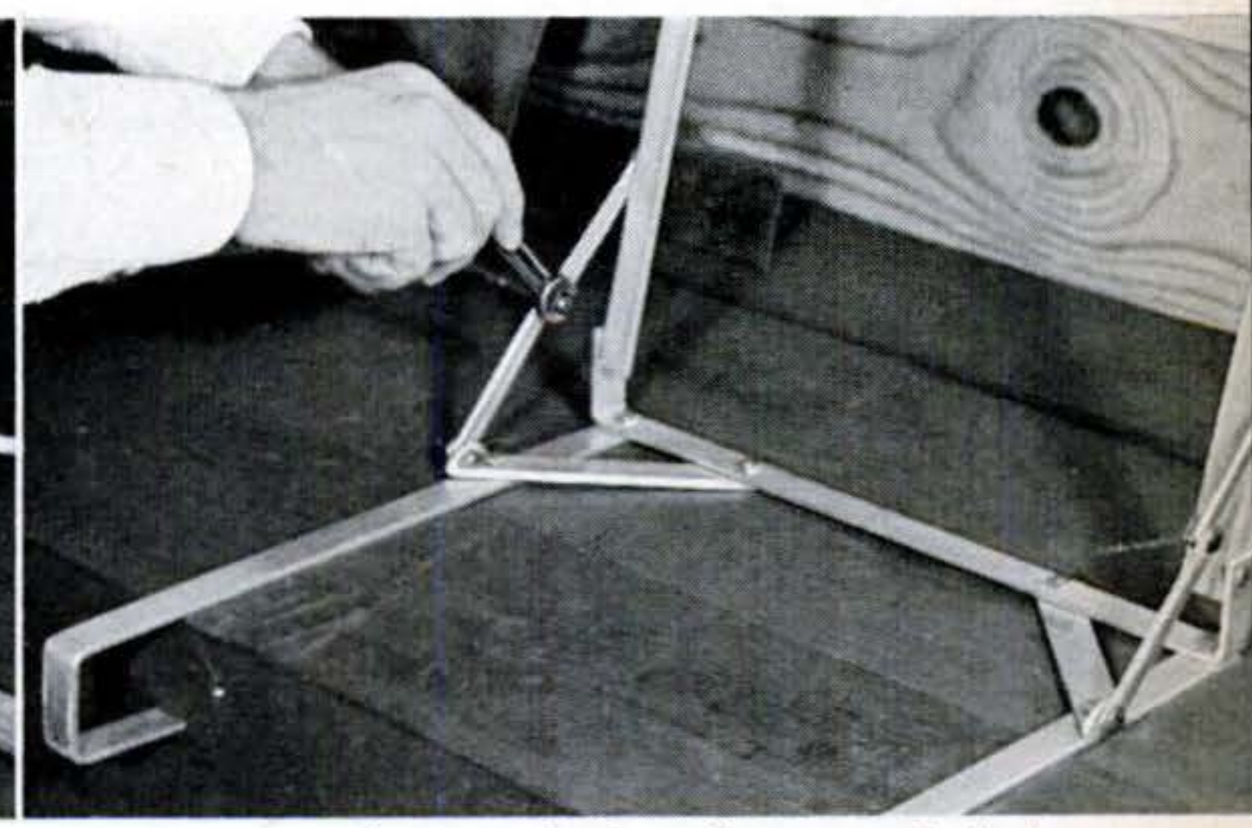
Quarter-inch plywood back is fastened in frame with six 10-24 bolts. Holes in the back give you finger grip for carrying the chair.



Braces across the rear corners of the bottom hold the frame square and also form brackets for attaching the two side braces.



Back assembly and bottom frame are hinged with two small bolts. Countersunk heads of bolts go on outside of frame and nuts on inside.



Side braces, also attached to frame with bolts, have a bolt hinge at their centers so the chair can be folded flat for carrying.

bend it to form the U-shaped back. Drill holes, bolt the plywood to the frame, and the back assembly is finished.

Building the bottom. Hacksaw the aluminum strap to the lengths shown. All parts of the bottom—sides, rear, and the two braces—have to be bent. The front ends of the side pieces are bent so they will hook over the edge of a stadium seat. After bending, locate and drill the holes, and assemble the parts with bolts, countersinking them.

Assembling the stadium seat. The two bottom photos on this page show you how to join the back and bottom. Each hinged side brace is made up of two identical lengths of ⅜" strap. For looks, round the ends of these parts with a file.

All that remains to be done now is to slip the cushion in place and you're ready to watch any sporting event in comfort. END

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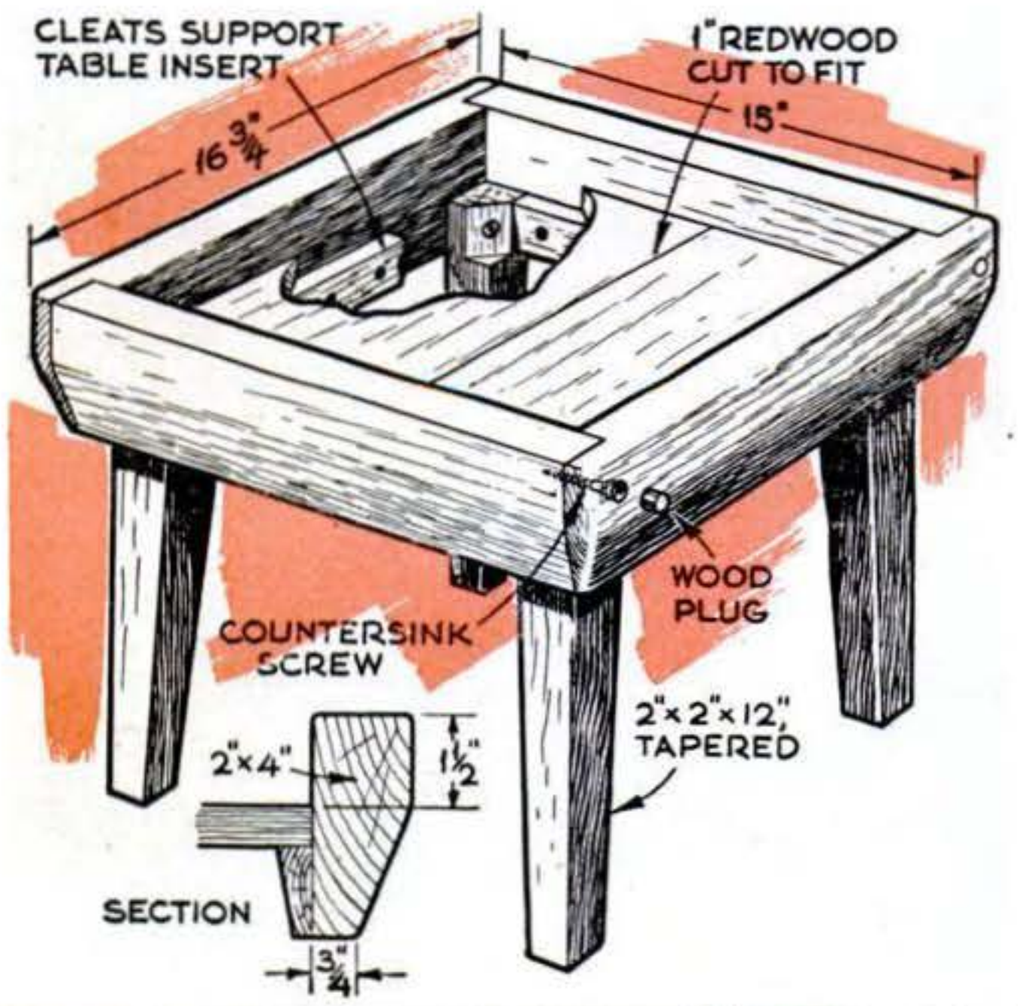
Footstool Is a Snack Tray, too



WHETHER you go for sittin' or eatin', here's a piece of furniture that will cater to your comfort. It's a combination footstool and snack tray you can use in a parlor, porch, or sun room. It's easy to carry, a pleasure to use, and a cinch to build.

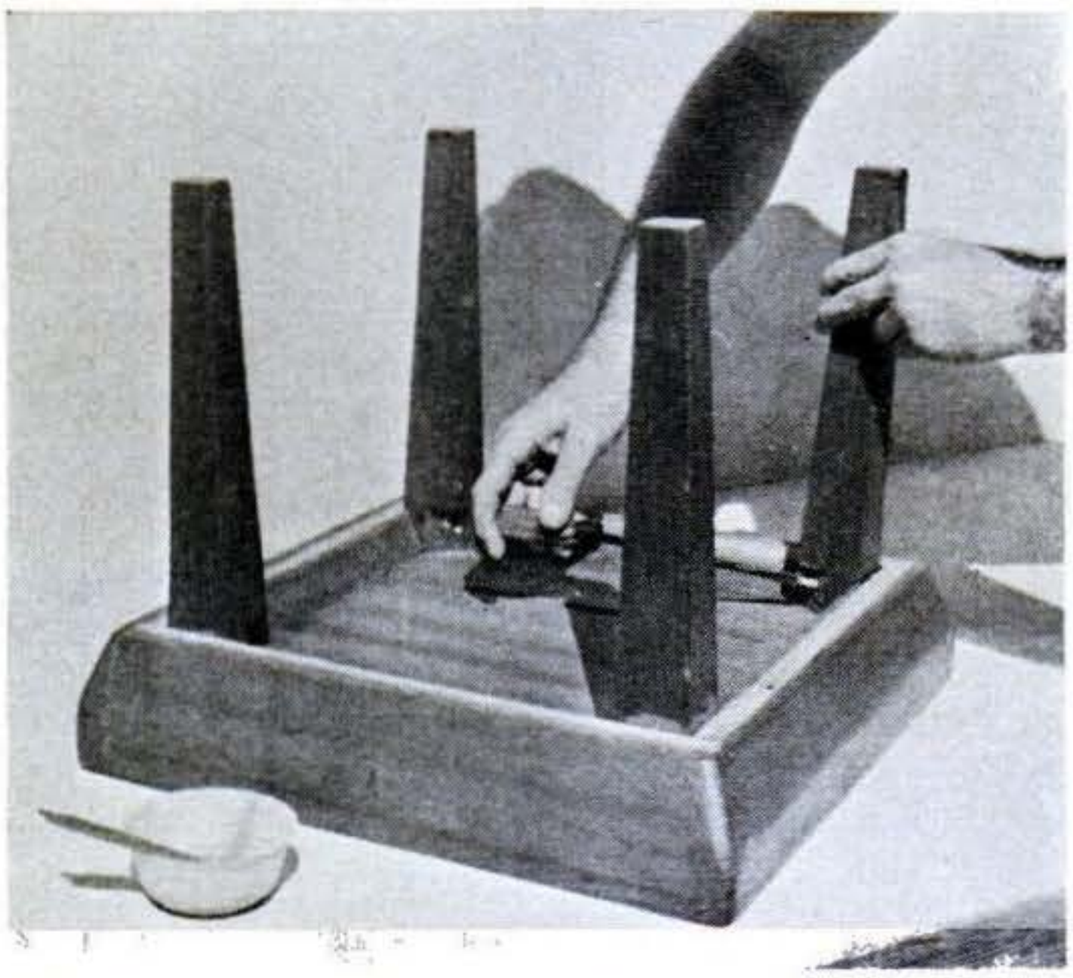
I made mine from a few cents' worth of lumber and an old cushion. For the frame and legs I used scrap two-by-fours. I cut two pieces 15″ long, two 16¾″, and two 12″.

The first four form a frame for a 14″ cushion. I rabbeted the longer two, beveled the sides on all four, rounded the sharp edges, and glued and screwed them together as shown in the sketch.

I ripped the two 12″ pieces to make four two-by-two legs. I tapered them—though it wasn't really necessary—notched the corners, and glued and screwed them to the frame.

A couple of pieces of 1″-thick lumber serve for the recessed table top. They rest on cleats nailed to the frame flush with the tops of the legs.

I sanded the whole thing smooth and gave it three coats of water-white lacquer to preserve and protect the natural finish.—*Darrell Huff, Sonoma, Calif.*



The frame and legs are glued and screwed together; the cleats and table inset are nailed.

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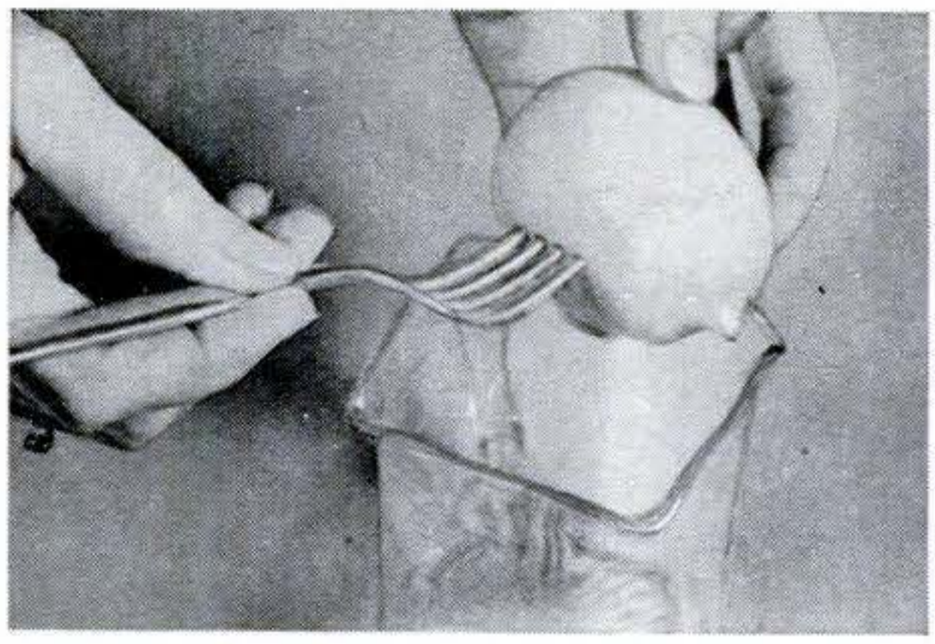
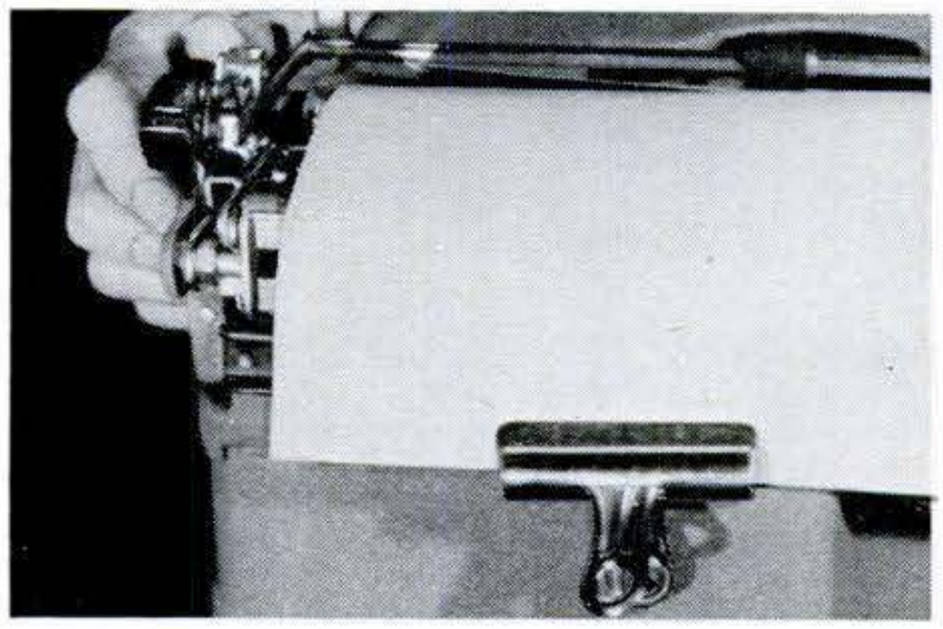
DO IT THE EASY WAY



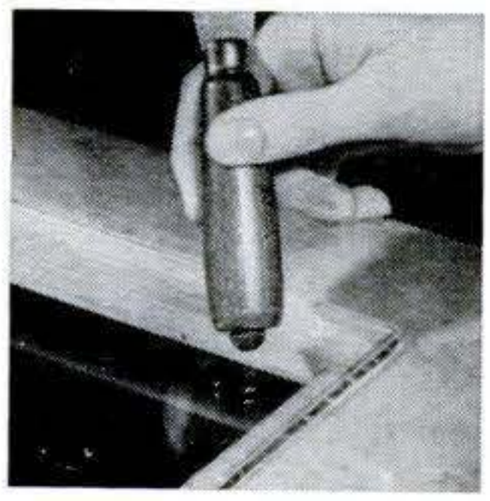
To prepare a salad dressing or other recipe calling for a few drops of lemon juice, don't cut the lemon or it'll dry out. Pierce with fork and squeeze out drops.



To keep the paper from blowing back over the typewriter platen when the electric fans are going, weight the end of the paper with a clamp-type paper clip.

To silence a loud-ticking clock in your bedroom, or an electric one that's begun to grow noisy, stand it on sponge or foam rubber. Much of the sound will be absorbed.

To tap a new pane of glass gently into place, with less danger of breaking or cracking it, use the handle of a putty knife into which a rubber-headed tack has been driven.



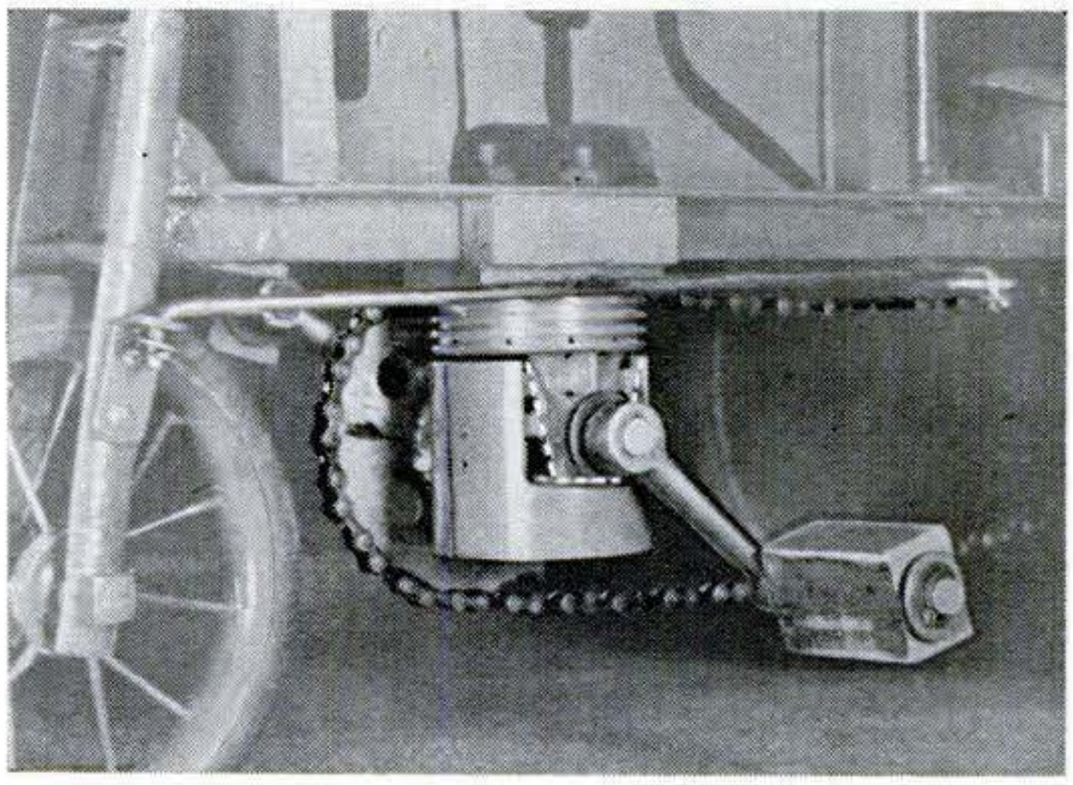
Electric Outboard Has Steering Brake

SETTING a thumbscrew locks the steering brake of this 25-lb. electric outboard motor, holding it on course and leaving your hands free to handle a fishing rod. The Trolmotor develops 1.1 hp. when powered by a 12-volt battery. Maximum speed is 5 m.p.h. on a 14′ boat carrying two persons. It also will operate several hours on a 6-volt battery, says the maker, LeJay Mfg. Co., Minneapolis. About $50.

Masking Tape Holds Small Parts

WHEN you're working on models or instruments, masking tape can be used to hold small parts for inspection, painting, or work. Use thumbtacks to hold the strip of tape—sticky side up—to your workbench.—*Morris Tanenbaum, Cleveland.*

Piston Makes Pedal Hanger for Toy



IF YOU'RE making a pedal-driven car or tractor for the kids, the crankshaft mounting needn't be a headache. Simply drill two holes in the head of an old piston and bolt it under the frame of the toy with the wrist-pin holes crosswise. Pick a shaft that is a tight fit within the wrist pin, or else wedge or pin it in. The wrist pin thus becomes the running shaft, and will be free-turning and durable.

Pedals can be salvaged from an old tricycle or other toy. The appearance of the hanger can be improved by cutting away the piston skirt as shown by dotted lines. —*Wilber H. Fulker, Monument, Colo.*

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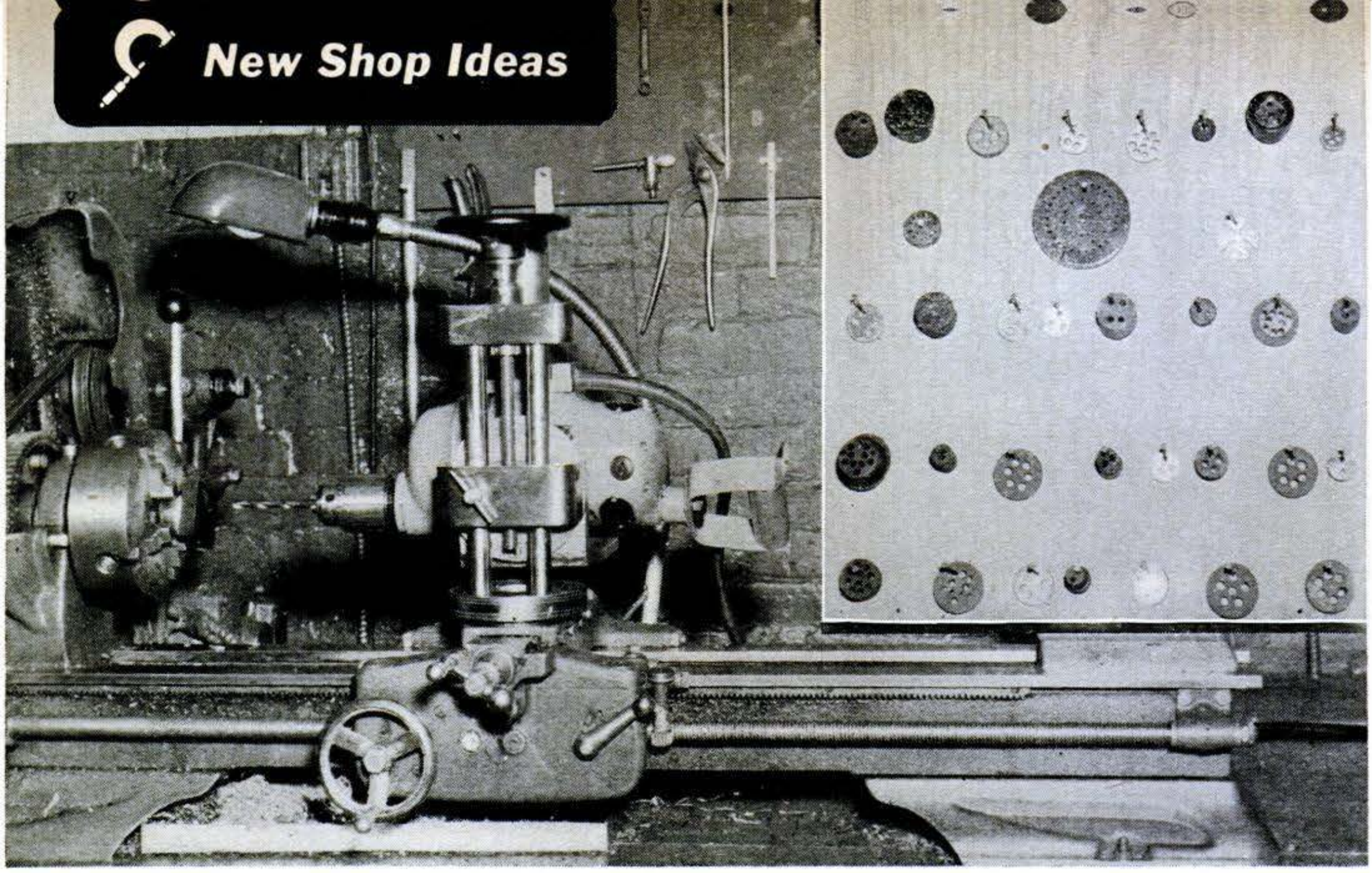
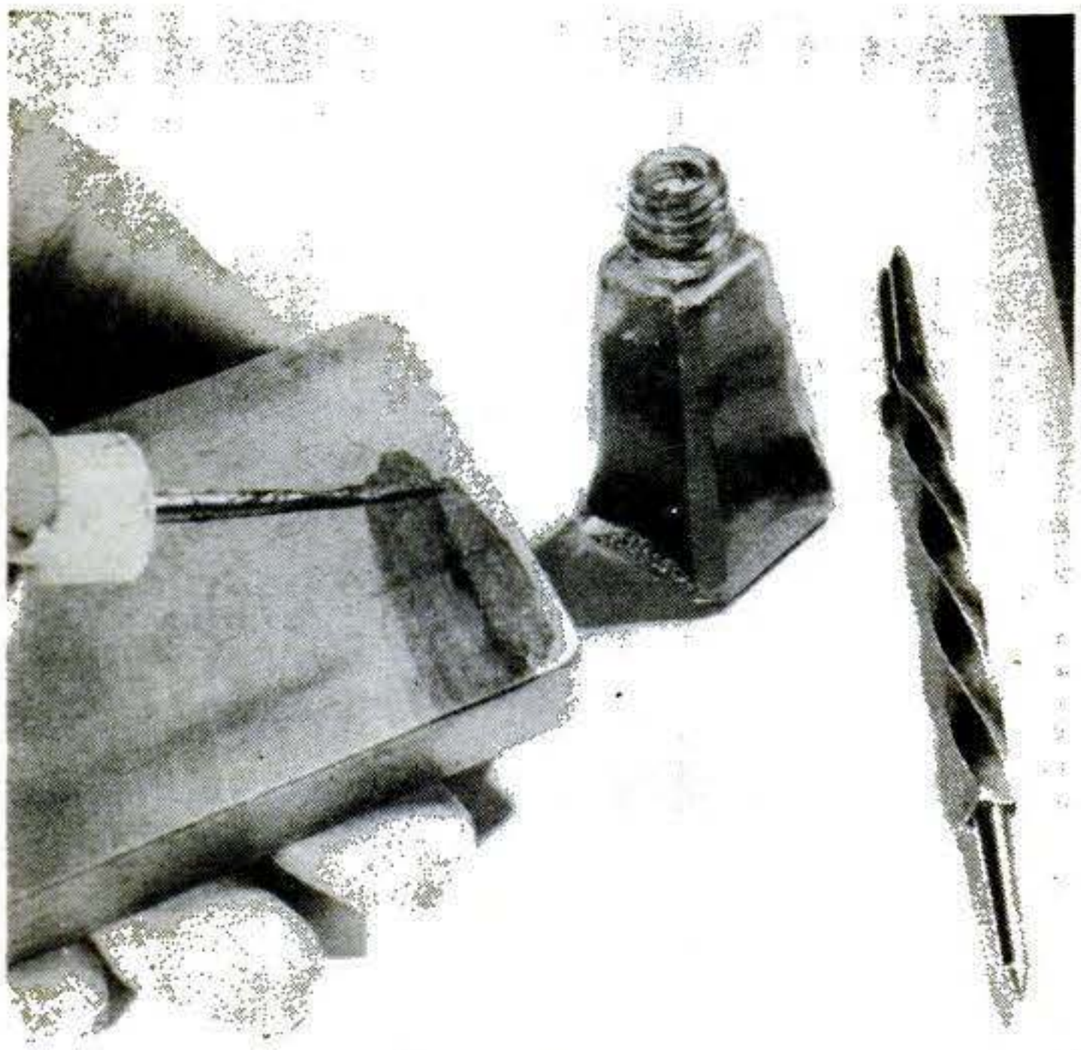
New Shop Ideas



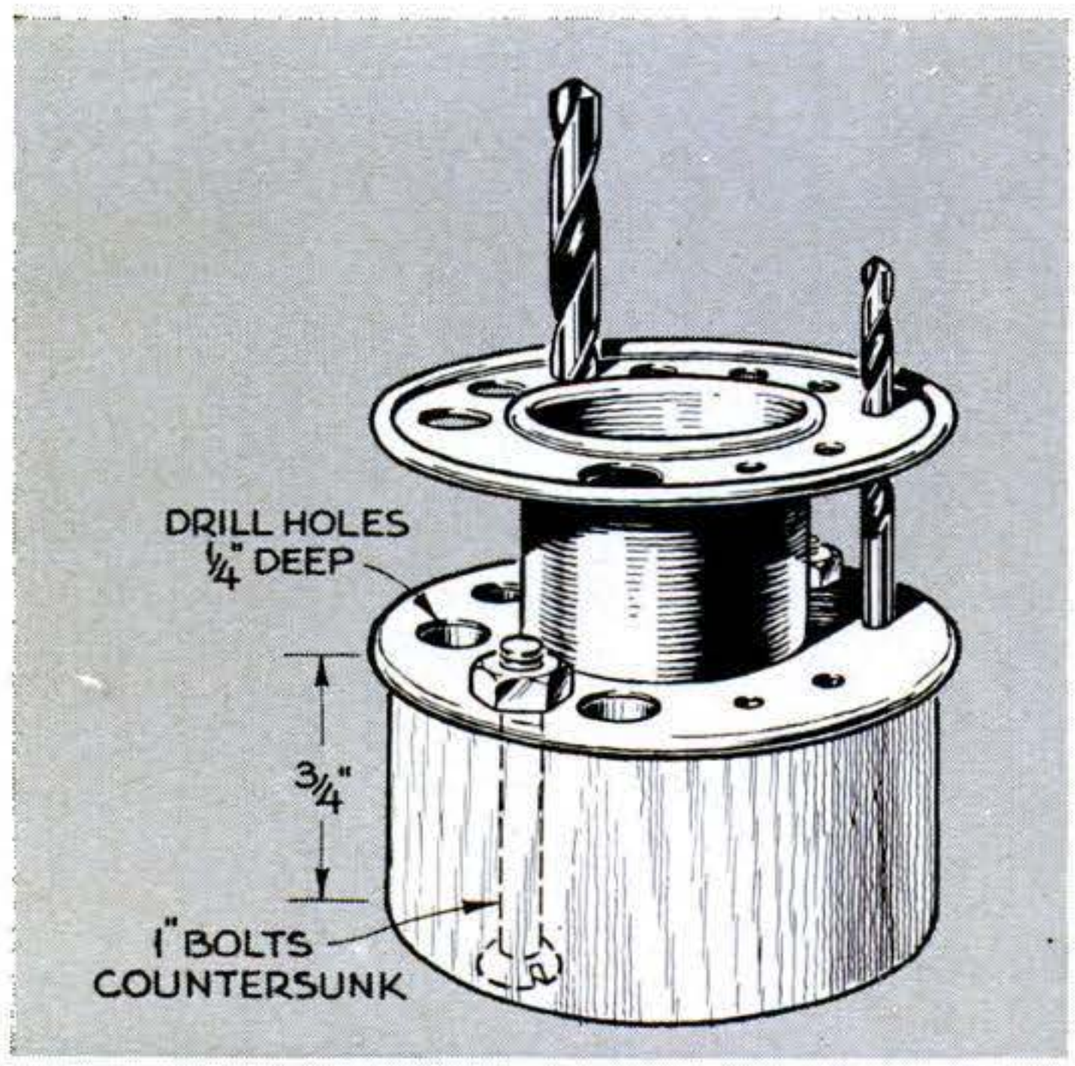
Radial Drilling. An electric drill mounted on the cross slide of a lathe makes very accurately spaced holes. The cross-feed graduations will locate the holes on any radius within a thousandth, while the spindle index will space them accurately at any radial angle.

In the setup shown above, a cradle for the drill was attached to a specially built mount with vertical adjustment. However, any arrangement for clamping the drill on the saddle at exact center height, and parallel to the ways, would do the job.

The inset photo above shows some of the work done in this way.—*William B. Goodrich, Somerville, Mass.*



Bottle Saves Layout Blue. Of all the containers you can use for keeping layout blue on the bench, a nail-polish bottle is perhaps the best. The brush in the cap is always handy and just right for small jobs. Because the neck is small, less fluid evaporates away and less spills if you accidentally knock the bottle over.



Tape Spool Holds Drills. A good bench stand for extra drills can be made from a fairly wide adhesive-tape spool. Bolt it on a wooden base, temporarily support the top flange with a piece of wood between it and the bottom one, and make each hole with its own drill.—*George Kapitan, New York City.*

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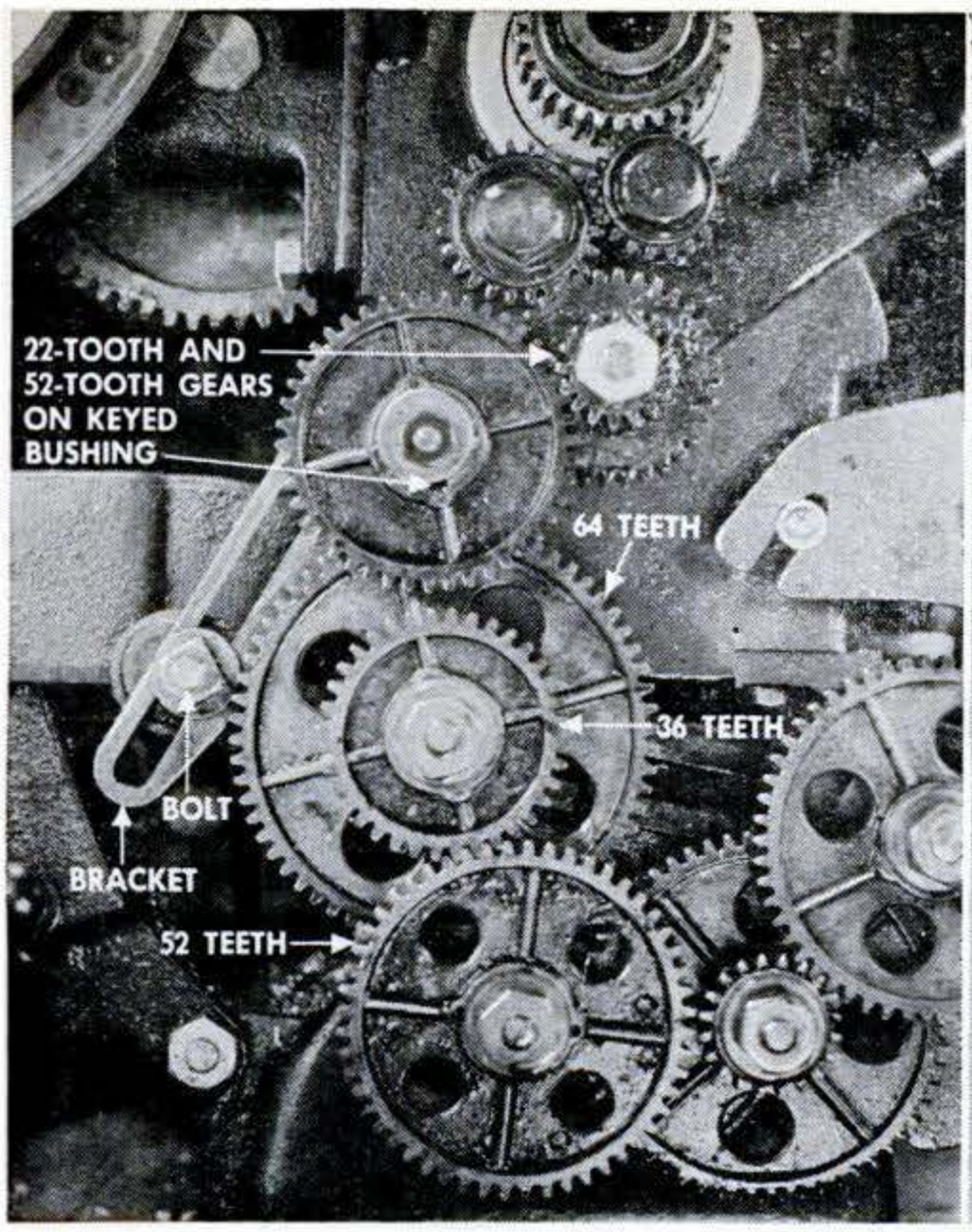
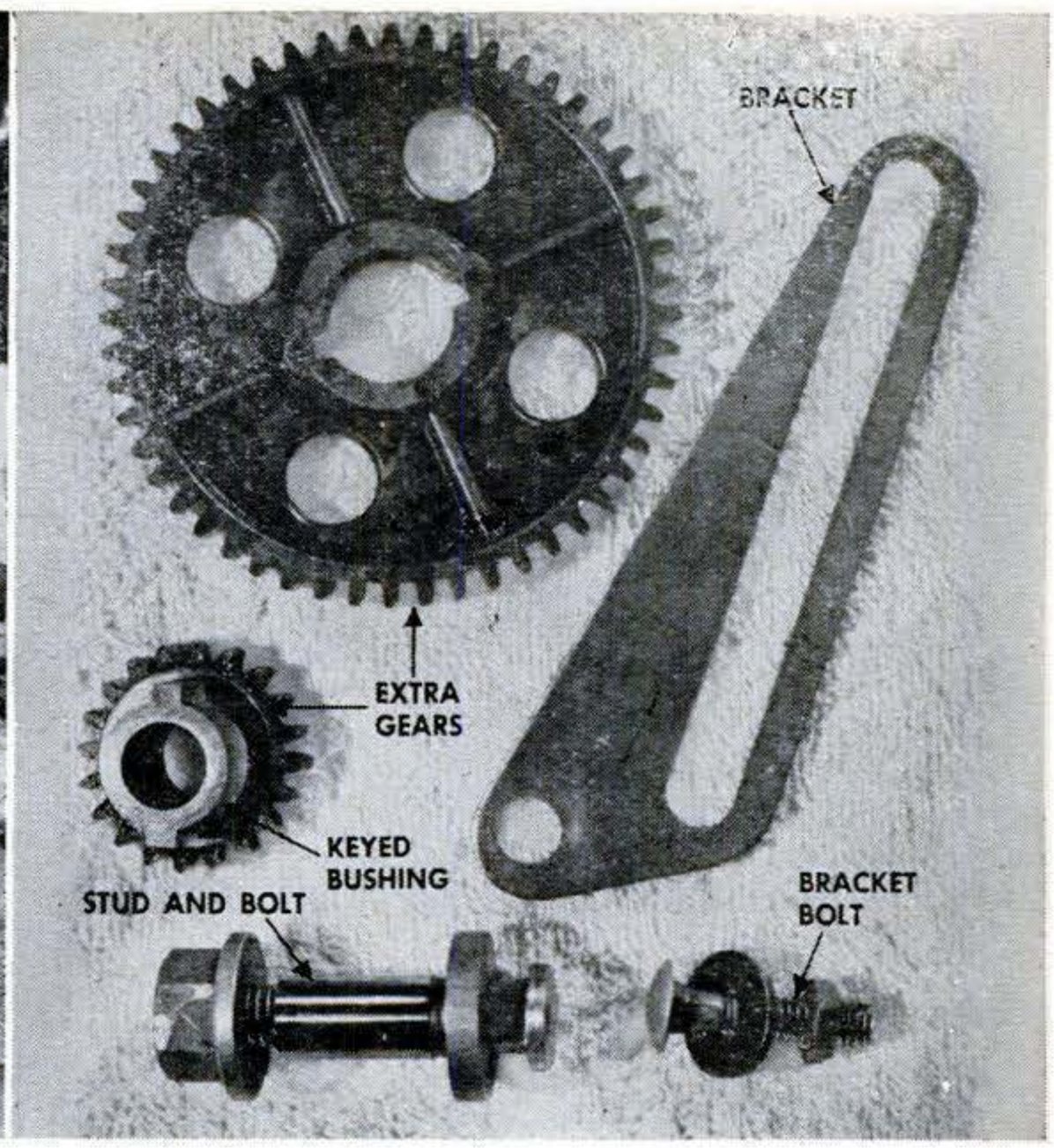




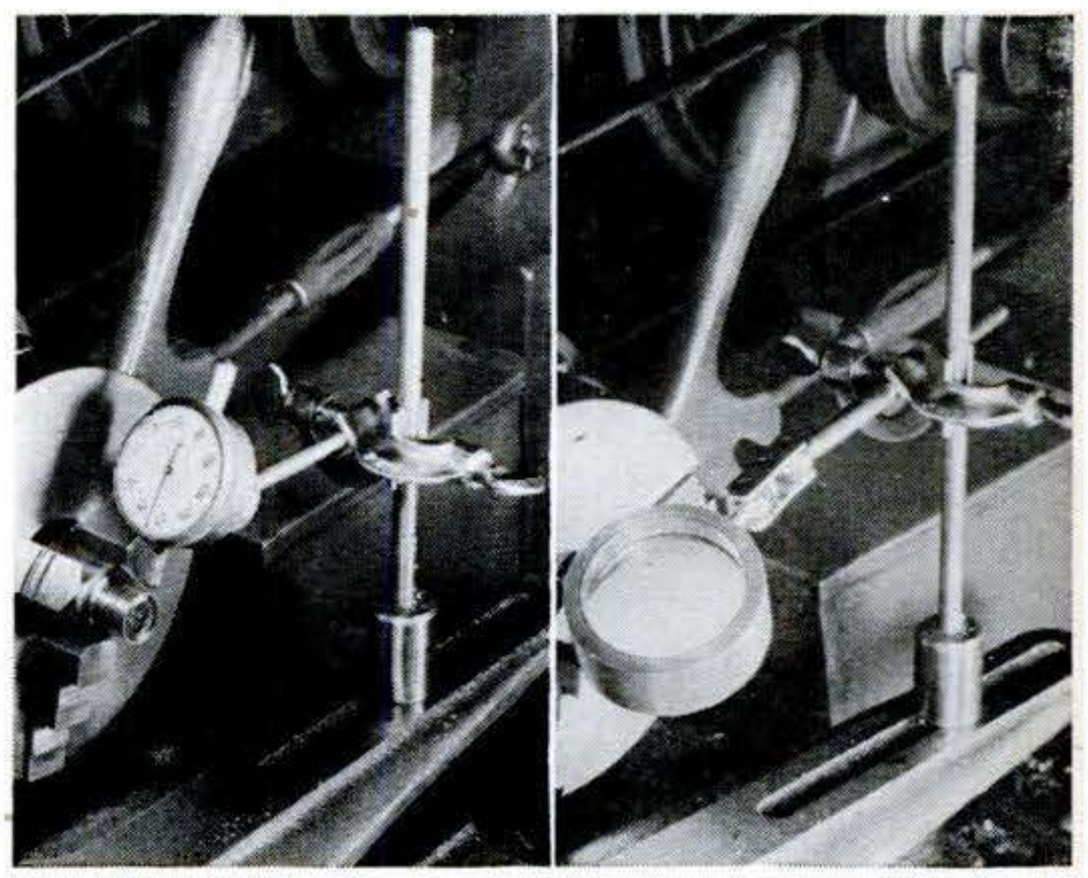
Superfine Lathe Feeds. If a job requires finer feeds than the normal compound-gear setups can handle, add an extra gear assembly. In this case a cross-feed of .001″ was needed, while the finest available with a normal gear train was .0024″.

A 22-tooth and a 52-tooth gear were mounted on a keyed bushing, the smaller gear behind. This assembly was free to rotate on a regular stud and bolt assembly, which was mounted on one corner of a bracket borrowed from an angle vise. The bracket was bolted to the end of the compound-gear sector.

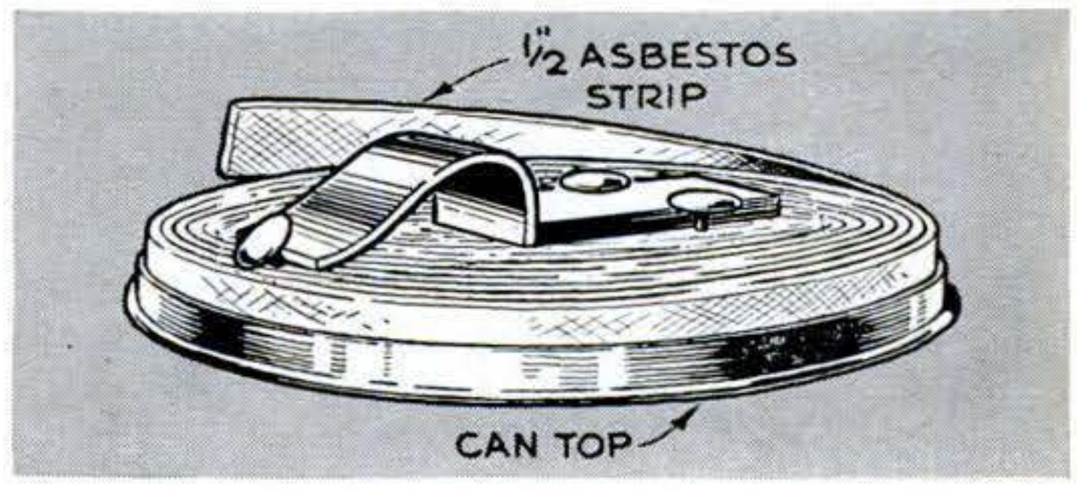
The gear chain resulting gave five reduction steps instead of four. Intermediate feeds coarser than the one obtained this way can, of course, be set up by choosing the proper combination of compound gears. If no bracket is available, one can be cut from plate, the slot being drilled and filed to shape.—*Harry L. Truchelut, Atlanta, Ga.*

Handy Clamp Setup. An inexpensive two-way rod clamp of the kind used in chemical labs is useful in the shop. In one photo at the right, it holds an indicator; in the other, it supports a magnifying glass for inspecting a delicate turning job.

The upright is a ¼″ rod threaded about 1½″ to fit a tapped collar. A nut under the slotted cross slide clamps it tight. If your slide isn't slotted, drill and tap a hole in it, or mount a tapped boss with screws. With a suitable nut and with wrench flats on the collar, you can mount the upright in T slots of other machines.



Pin Down the Job. It's much easier to solder small pieces together if you hold them on an asbestos block with pins or thumbtacks. A good block for the purpose, and for silver soldering too, can be made by cutting sheet asbestos into ½″-wide strips and coiling them up in a coffee-can lid.—*Arthur F. Yaw, Seeley, Calif.*



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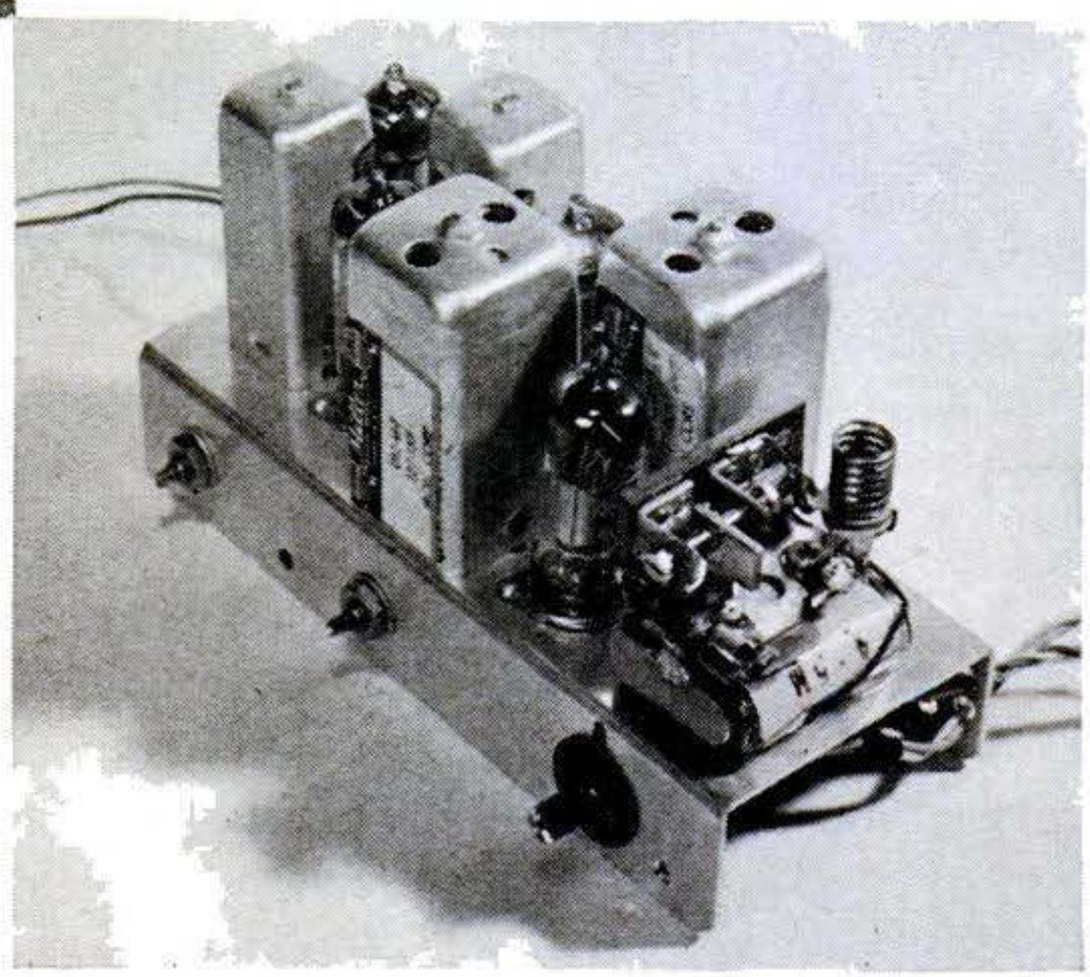
Look, Pa...

No Hands, No License

This radio can open garage doors, run a lawn mower, or steer a boat. And you need no license to use it.

By Howard G. McEntee



LET'S dream a little. You lie in a hammock on a warm day with a cool drink in one hand. With the other you jiggle a switch on a small box by your side. And fifty feet away, a power mower trims your lawn, about-facing at the end of each swath. When the chore is done, it rolls into the tool shed, and the engine dies.

Or you're a modelmaker with a new power boat. You put it in the water, and a finger on a control panel starts it up. You maneuver it out, race it between floats, bring it back alongside the slip. Invisibly, your hands are on the tiller all the way.

Radio control does things like that. But Uncle Sam says you have to have a ham license to work a short-wave control rig. Does that leave you panting behind a mower, or running your boat in circles?

It needn't, because there is a radio-control system you may use without a license. Called RF induction, it's widely used for "wireless" phonographs, garage-door openers, and campus broadcasting stations.

Keep it legal. The Federal Communications Commission permits transmission of this kind—provided it does not interfere with other radio services or exceed a certain signal strength at a given distance from the antenna. The transmitter pictured on the facing page stays well within the legal limits, yet packs enough sock for a host of radio-control applications.

So far, I'm still dreaming of my robot lawn mower, garage-door opener, and maybe a miniature Army tank. But I have actually put radio control to work in a model cruiser. I can guide the craft within an 80′ radius (or a 160′ circle if I take the transmitter out in a rowboat), and I can boost this range by using a larger loop antenna on the receiver.

The transmitter. You don't need a fancy transmitter. The photos show how simple mine is, and I built in a couple of operating frills that aren't essential.

I housed the whole broadcasting station—batteries and all—in a 5″ by 6″ by 9″ steel box. A strip of brass on the bottom of the case was drilled and tapped ¼″-20 to fit a tripod screw. A similar arrangement on top fastens the loop antenna.

Parts layout isn't critical, and a few items shown in the diagram can even be omitted. Among these are the meter and thermocouple, which I salvaged from a two-dollar, war-surplus antenna unit from a BC-442 transmitter. The meter provides a handy check on transmitter operation, but if you can't get one cheaply, leave it out and join

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Transmitter at right is steering boat at left. Antennas are flat to avoid directional effects.

the two wires that go to the terminals marked "line."

On the front panel under the meter I mounted two jacks. The regular phone jack is for the transmitter "key," which can be a simple on-off switch or a control mechanism such as is shown on page 206. The second jack—also optional—furnishes 1.5 volts to operate the control motor.

The receiver. The other end of the radio control resembles an ordinary superhet receiver. To conserve space I bent up my own chassis out of sheet aluminum. The size of the coils, tubes, and relay limit the amount of squeezing you can do; the remaining parts have room to spare under the chassis.

I wound the antenna loop on a 1½" by 3⅞" by 6⅛" plastic box. If you don't have one like it, cut a block of *dry* wood to the same dimensions. A larger loop would make the receiver more sensitive; if you make it larger, however, you'll have to use fewer turns and a smaller capacity for C4. If you redesign the antenna or build it into a model, keep it away from metal.

Testing the units. I normally operate the transmitter on a 90-volt B battery, but when I want to stretch the range a little—as when my boat sails out of control—I switch in an extra 45 volts. I haven't gone beyond 135 volts because it would be illegal—and would also damage the 1S4 tube.

The scale on the antenna meter is marked arbitrarily from 1 to 10. It should read about 4 when the transmitter is operated at 90 volts and 7 at 135 volts. The pointer should not go over 8.

If you have omitted the meter you can check the transmitter by plugging an ordinary 0- to 25-milliampere DC meter into the key jack. It should read about 10 ma. at 90 volts.

It is fairly simple to tune up the receiver, but you will save time if you can lay hands on a signal generator and a 0-to-1 milliammeter.

Connect the meter to the receiver test jack. When no signal is being picked up it should read about .6 ma. If you have a signal generator, set the dial to 150 kc. and connect the output leads across the outside terminals of the transmitter loop. Rotate the screws on the three receiver trimmer condensers until the meter shows its lowest reading. Then adjust the tuning screws on the transformer cans and see if you can lower the meter needle.

If you don't have and can't borrow a signal generator, proceed as follows:

1. Check the meter reading in the "no signal" condition, as above.
2. Turn on the transmitter and dial its tuning condenser while you watch the meter at the receiver.
3. If the meter doesn't change, adjust receiver trimmer C3 about a quarter turn and repeat step 2 until the receiver meter dips.
4. Touch up the receiver trimmers and transformer screws till you get the lowest

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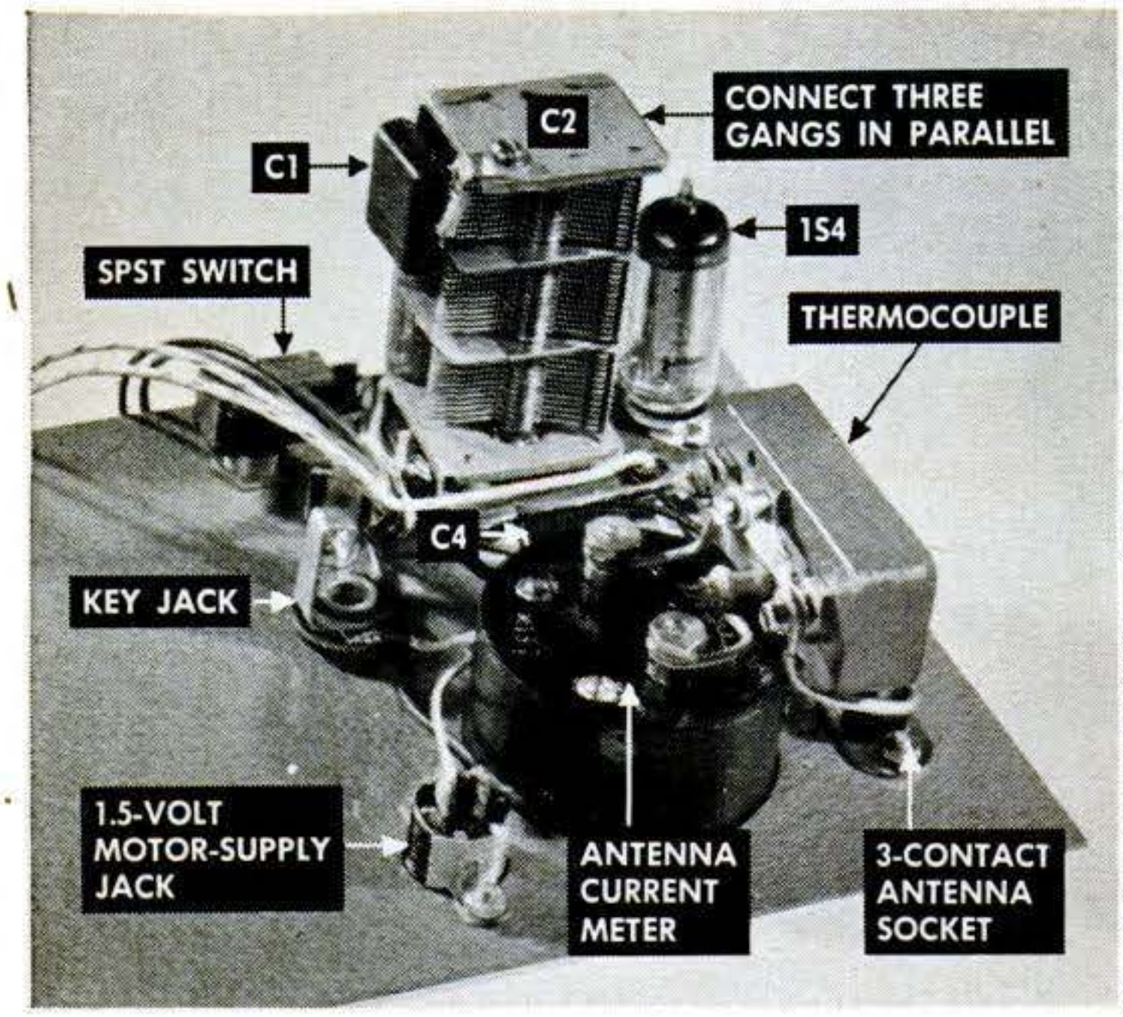
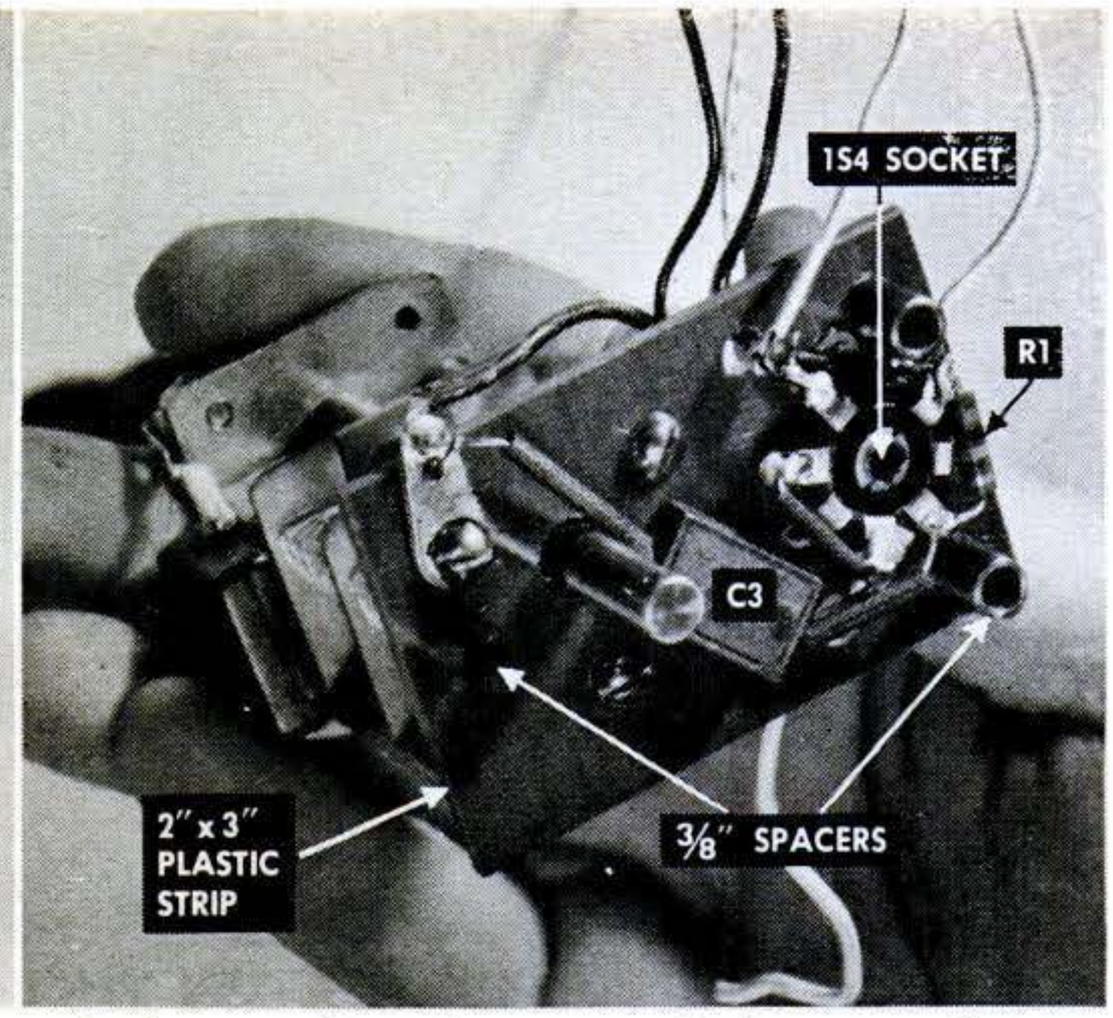
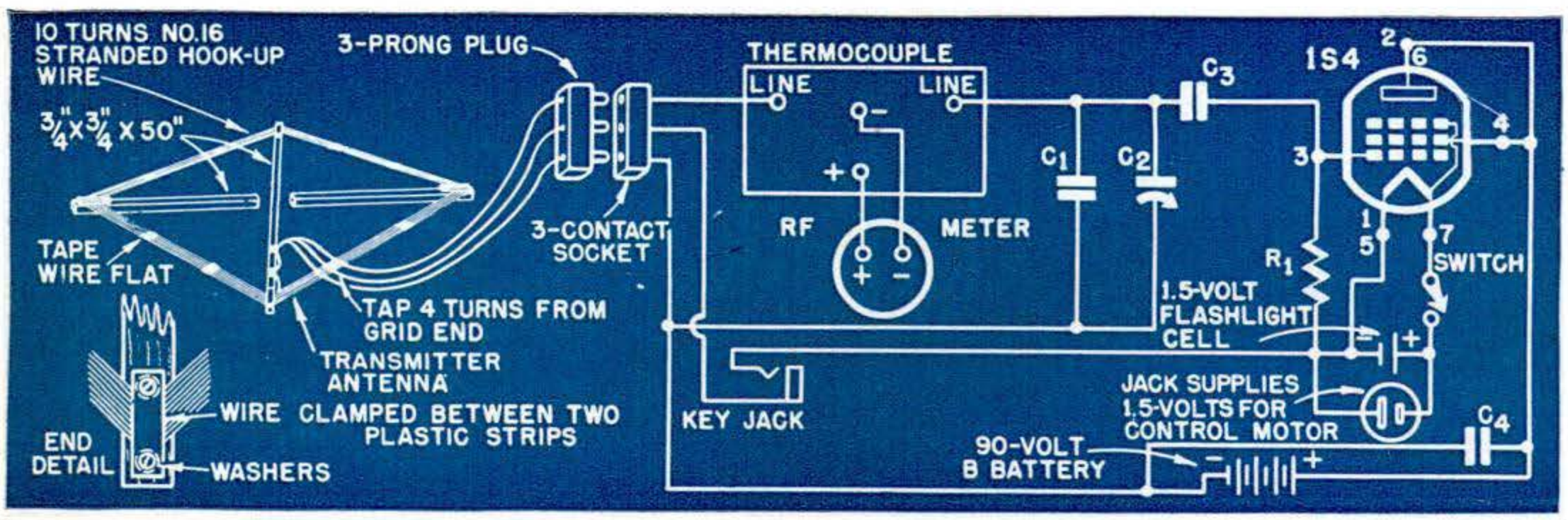




Transmitter chassis is panel of steel box. Tuning condenser must be insulated from case; I mounted it and tube socket on plastic (right). Shaft goes through oversize hole in panel. Circuit below should be used with antenna shown or signal strength may exceed legal limit.



LIST OF PARTS FOR TRANSMITTER

C1: .003-mfd. mica.
C2: midget 3-gang tuning condenser, 365-mmf. each section (J. W. Miller Co. No. 2113 or equivalent).
C3: .001-mfd. mica.
C4: .005-mfd. mica.
R1: 22,000-ohm, ⅓-watt carbon.
3-prong plug and socket for antenna connection; 125 ft. No. 16 stranded hook-up wire for antenna (see sketch); meter and thermocouple from surplus BC-442 antenna unit (optional, see text); SPST toggle switch; dial plate and knob; phone jack; two-contact socket; 1S4 tube and 7-pin miniature socket; 5" by 6" by 9" case; 1.5-volt A battery, 90- or 135-volt B battery.

reading. If the needle goes to zero, move the receiver further from the transmitter.

When you have both units in operation, but before you remove the receiver test meter, set the relay contacts. The relay should operate at .5 ma. and open at .4. The contact adjustment screws regulate its response. You can change the current that reaches it by detuning the transmitter or signal generator. If you order your relay from the factory, ask them to preset it at these values.

Control system. A model boat hull 27" long with an 8½" beam just comfortably holds the receiver, steering unit, and an electric drive unit. You could get more speed, of course, with a gas engine, but you wouldn't be able to start it up again by remote control once you stopped it.

Minimum control calls for right or left rudder in any desired degree, plus full ahead or stop. This sounds like a lot to wangle out of a single control channel, but you can do it by pulsing the transmitter.

A small permanent-magnet motor is connected to the rudders through a gear train that moves them from one extreme to the other in about six seconds. Two single flashlight cells are so connected across the relay points that when there is no signal, one cell turns the motor to give right rudder. Reception of a transmitter signal flips the relay, closing the other cell circuit and reversing motor polarity to give left rudder.

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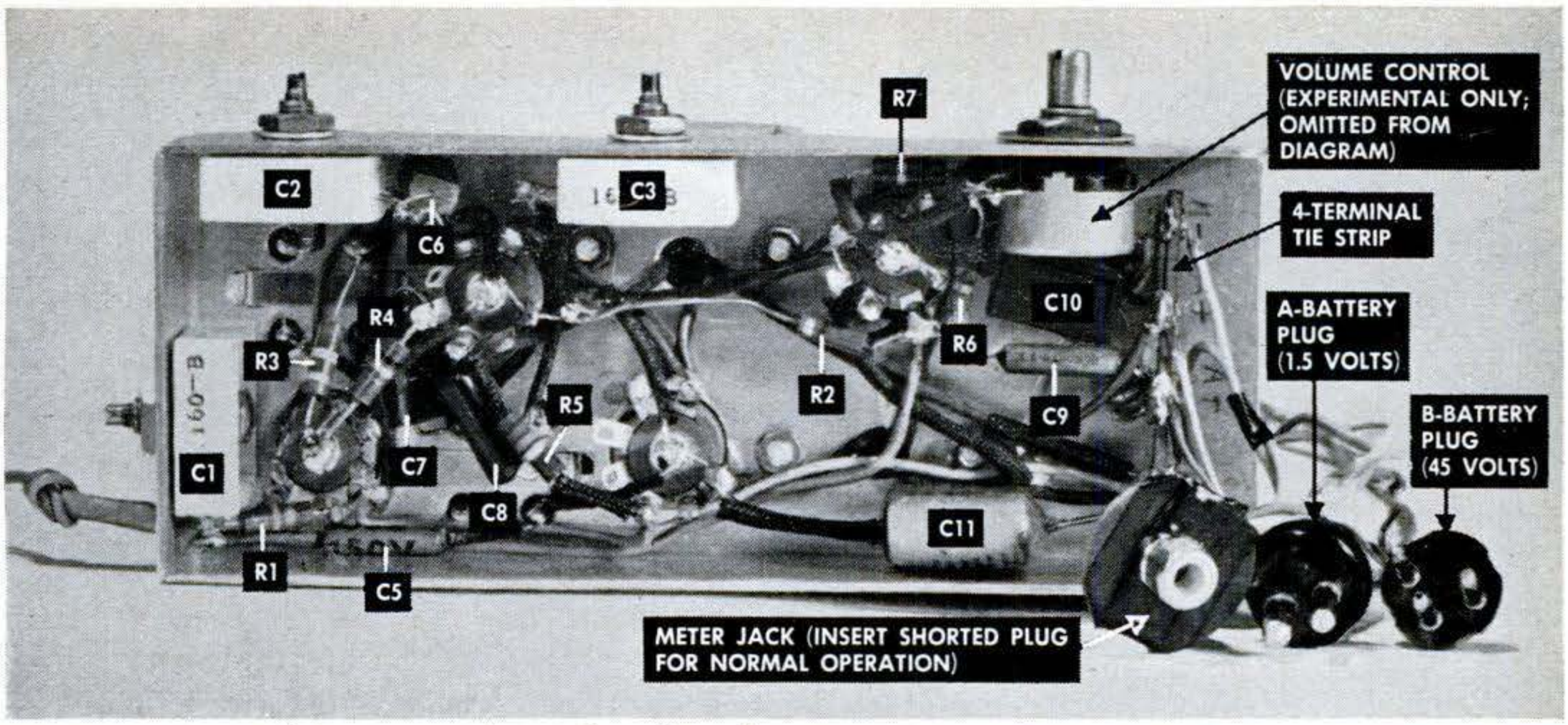
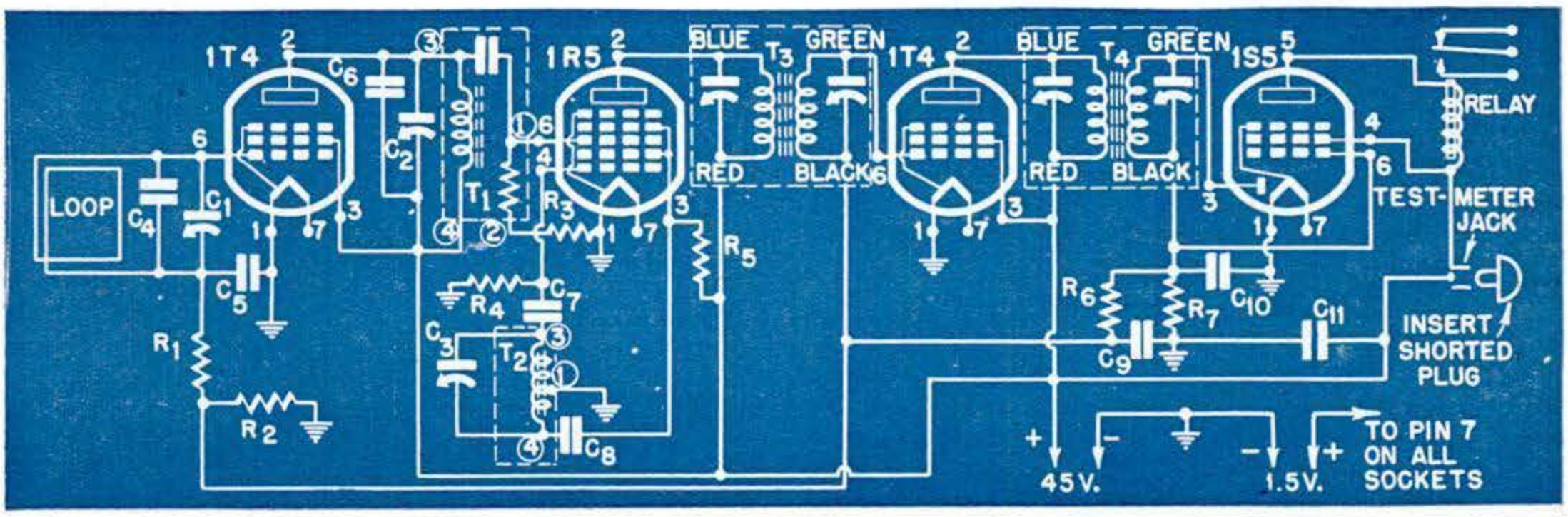


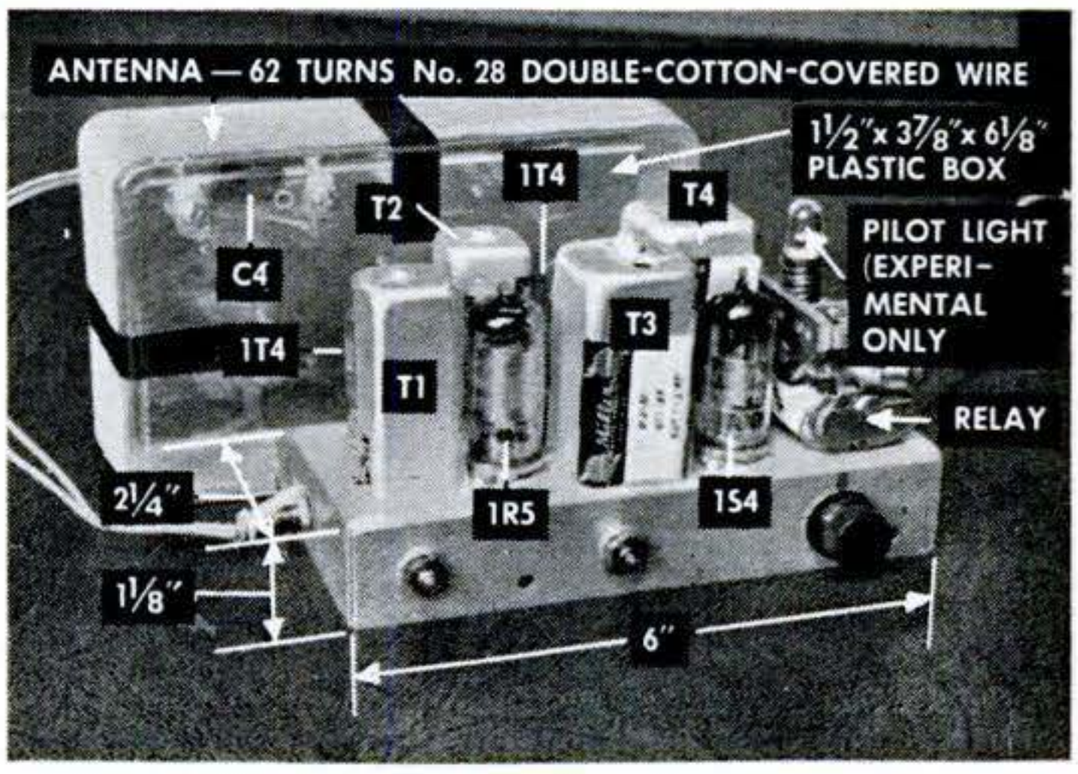
Volume control (shown in photo above) and pilot light are omitted from diagram (below) because they play no part in actual operation. Contacts on RF and oscillator coils, T1 and T2, are numbered on cans. Follow diagram numbers even if different from manufacturer's data.



LIST OF PARTS FOR RECEIVER

C1, C2, C3: 50-400-mmf. mica compression trimmers (Miller* 160-B or equivalent).
C4: .00125-mfd. mica (.001 and .00025 may be used in parallel).
C5: .002-mfd., 150-volt midget paper.
C6: 100-mmf. mica.
C7: 150-mmf. mica.
C8: 500-mmf. mica.
C9: .001-mfd., 150-volt midget paper.
C10: 250-mmf. mica.
C11: .25-mfd., 100-volt paper.
R1: 47,000-ohm, ⅓-watt carbon.
R2: 2.2-megohm, ⅓-watt carbon.
R3: 270,000-ohm, ⅓-watt carbon.
R4: 22,000-ohm, ⅓-watt carbon.
R5: 27,000-ohm, ⅓-watt carbon.
R6: 1-megohm, ⅓-watt carbon.
R7: 2.2-megohm, ⅓-watt carbon.
T1: 140-425 kc. miniature RF coil (Miller* X-121-RF or equiv.).
T2: Miniature oscillator coil (Miller* X-121-C or equiv.).
T3: 127-137 kc. input IF trans., iron core (Miller* 012-M1 or equiv.).
T4: 127-137 kc. output IF trans., iron core (Miller* 012-M4 or equiv.).
Relay, 10,000-ohm SPDT plate-circuit (Sigma Instruments, South Braintree, Mass. Model 5F, or 8,000-ohm model 4F, or equivalent).
Tubes: 1T4 (2), 1R5, 1S5 and 7-pin miniature sockets (4); aluminum for chassis; 4-lug terminal strip; phono jack (for meter) and shorted plug; 1½" by 3⅞" by 6⅛" plastic box and ¼ lb. No. 28 D.C.C. wire for antenna (see photo); 45-volt B battery, 1.5-volt A battery.
*J. W. Miller Co., Los Angeles.

The loop antenna is wound flat on a plastic box as shown. The Sigma 5F relay seen in photo is excellent but expensive; alternate, less costly unit in parts list also works fine.



This sounds as if you have to keep going from one rudder position to the other. But if an on-off pulse signal is transmitted, the relay flips up and down, making the steering motor turn just a few revolutions back and forth continuously. The rudders jiggle but don't move enough to have any effect. So whenever you want to make the boat

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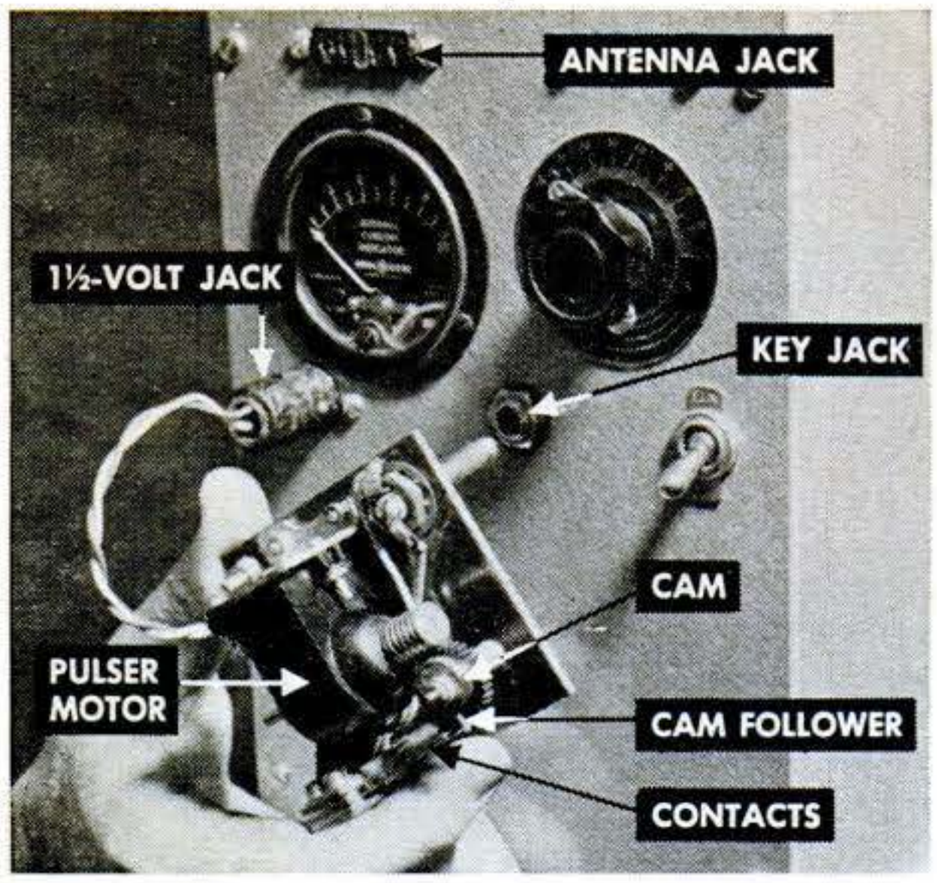
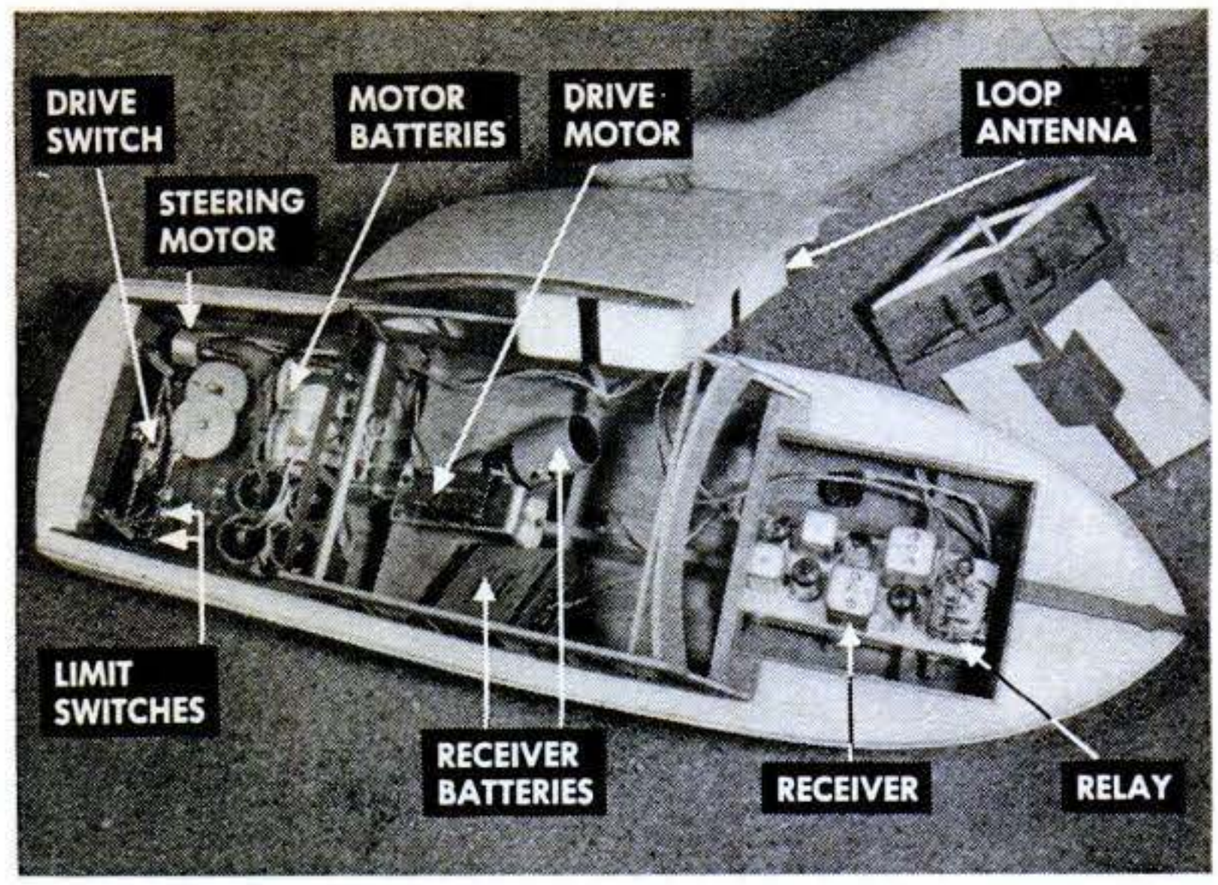
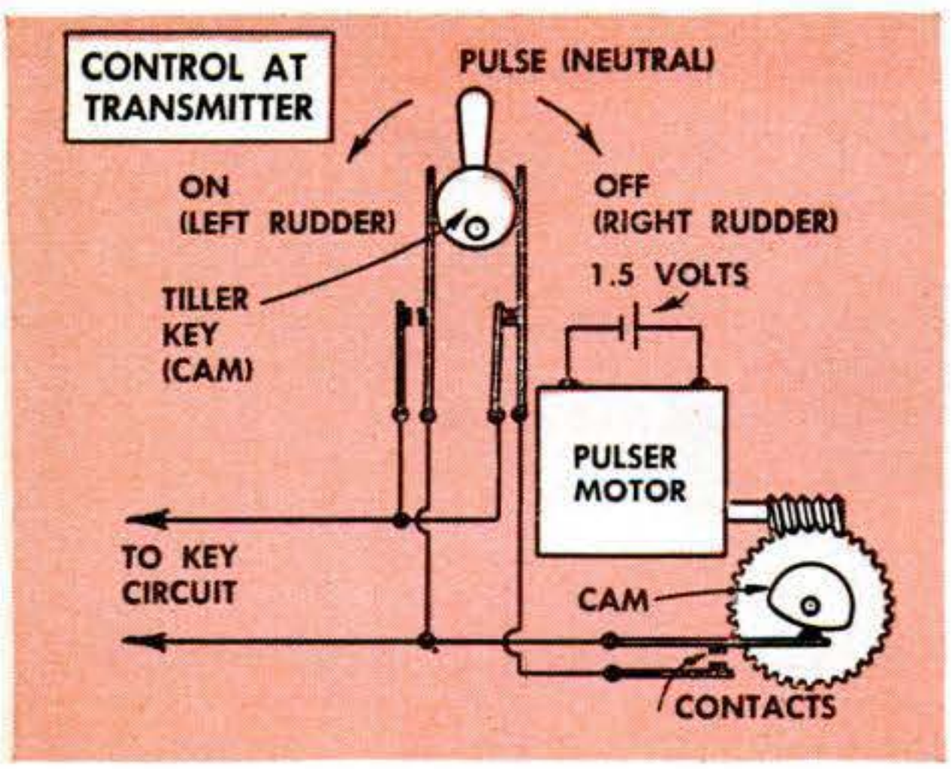
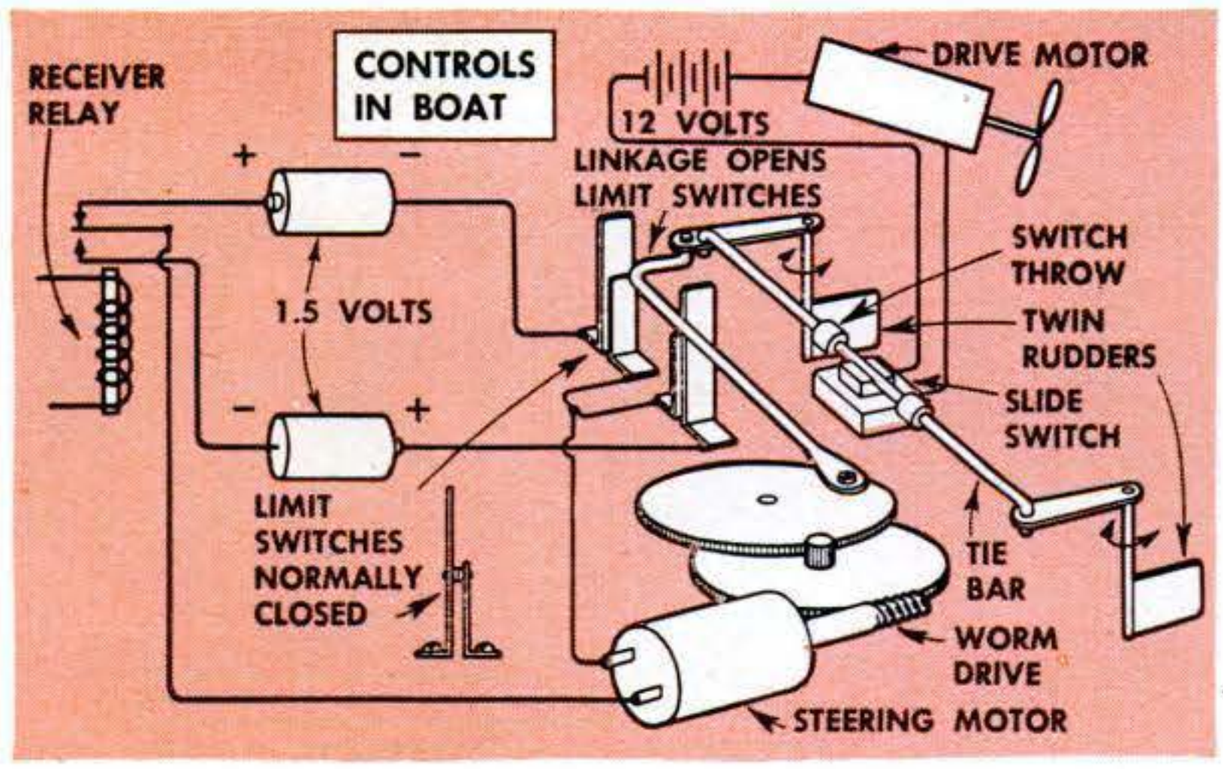


Transmitter is housed in metal cabinet. A plate in the bottom is tapped ¼"-20 for a camera tripod; the antenna mount, tapped the same way, is bolted to the top. A phone jack connects pulser into circuit, and a two-contact socket feeds juice from the A battery to the pulser's motor.



Control is installed in an Elco 35 cruiser from a kit made by Marine Model Co., of Halesite, N. Y. An oversize hatch was fitted to the forward deck to accommodate the receiver. The cabin roof was made removable and the loop fixed to it. A 12-volt motor drives the craft. Motor batteries and steering gear are in the stern.





go straight or keep turning in the same direction, you just send a pulsed signal at the point you want the rudders to stop.

The pulser. To time the pulse for on and off periods of the same length, I use a small battery motor with a 30-to-1 worm gear that turns at about 100 r.p.m. A brass cam on the gear is filed to a shape that will close a set of spring contacts during half its rotation. This gives an on-off pulse about 100 times a minute.

Control key. A telephone-switchboard type of key switch with right, left, and center positions makes it easy to visualize rudder movement. But two single-throw spring switches, one normally on and one normally off, will do. The switches are connected across the pulser so that in one position they short the pulser contacts (steady signal, left rudder) while in the other they break the pulser circuit (no signal, right rudder). Untouched, they let the pulser send its rhythmic on-off signal.

The steering linkage works between two limit switches, each a pair of normally closed spring contacts. At each extreme of travel, the linkage touches one contact leaf, opening the circuit through which the motor is being powered. It can't then be energized again except through the reverse circuit.

Drive control. To turn the driving motor on and off, a slide-type switch is mounted between two adjustable throws on the rudder tie bar. When the rudder reaches extreme left, the switch goes off. To turn the motor on again, the rudder must be swung over to the extreme right.

If the boat gets out of range (no signal), the relay throws to right rudder, leaving the motor on to bring the ship in a circle back toward the transmitter.

For partial rudder, the tiller key is held to one side, then centered. The rudder will stay on that side. END

Do you know how to adjust room lights for perfect TV viewing? See PS for September.

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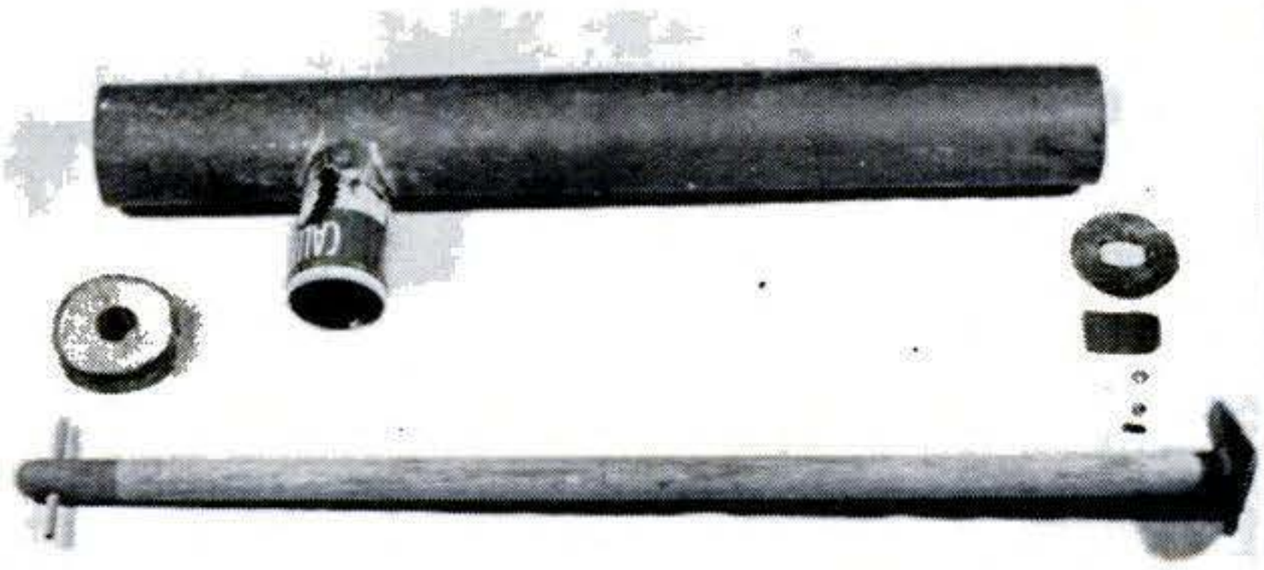
Drainpipe Makes a Bilge Pump

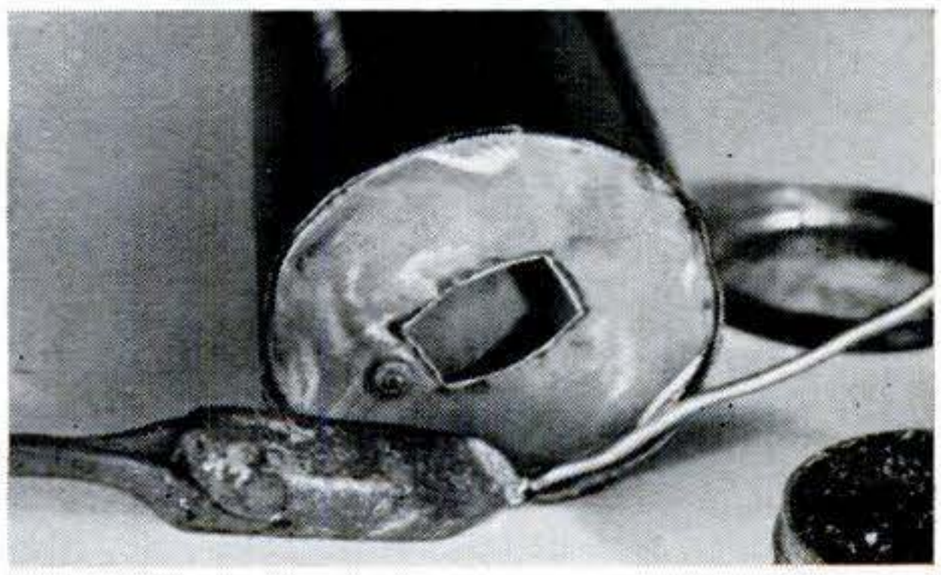
MOST any boat takes in water from seepage or rain, and this little bilge pump gets it out a lot faster than a bailing can does. You can make it from a 2′ length of round drainpipe with a hole cut about 6″ from one end. Solder a tin can into this opening to form the spout.

The intake valve is shown below at right. Cut a circular piece of sheet metal to fit inside the pipe. Then cut a hole in the center of the disk. The size of the hole determines how fast the pump will move water. Cut a flap from inner tubing and bolt it to the disk at one end to open and close the intake hole. If the rubber flap tends to pull through, solder a piece of coarse screen over the hole. Solder the disk to the pump bottom.

A piece of broom handle about 6″ longer than the pump makes the plunger. Cut a disk from a blowout patch, or other heavy rubber, to fit snugly inside the pipe. Fasten it to the plunger's end with a brass screw.

Cut a disk from ¾″ wood to fit upper end of the pump and drill a hole in it to take the broomstick. Slip it over the plunger handle and fasten it to the pipe with wood screws.—*Jim Miller, Moline, Ill.*



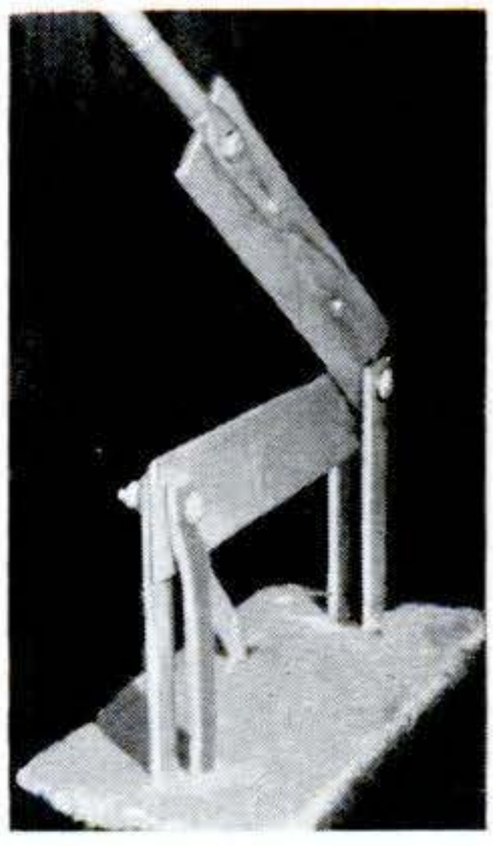


Tubing Used as Skillet Holder

I CARRY a 10″ length of aluminum tubing —brass will also serve—on camping trips. One end of the tubing has been flattened so it slips over the handle of my camp skillet. I find it much better for removing a hot frying pan from the fire than cloth pot holders that inevitably get dirty and are easily mislaid.—*John Krill, North Lima, Ohio.*

Metal Trimmer Speeds Shop Work

ONE of the handiest tools in my shop is this trimmer for cutting sheet metal and strap iron. I cut the two 18″ blades from an old road-scraper blade and set the ¼″ by 1″ strap-iron legs in a concrete base. It'll cut cold metal ¼″ thick and hot iron ½″ thick.—*C. A. Cole, Graham, Ala.*



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New, inexpensive slide projector

Kodaslide Merit Projector, only $24.50; carrying case, extra. The big news about this projector is the new, improved slide-feeding mechanism. You insert slides in *top* of projector—thus no jarring or moving of instrument. Large-sized lamphouse of unique, new design assures efficient cooling to keep slides flat. Built-in elevating mechanism for angles up to 10 degrees. Other features: (1) Lumenized Kodak Projection Ektanon Lens, 5-inch *f*/3.5; (2) ready access to optical system for cleaning; (3) powerful 150-watt lamp.

Color Show

Think of shooting and showing your own personal pictures in glorious full color with Kodachrome Film! It's one of the biggest thrills in photography. On these pages you see some of the latest equipment and accessories now offered for projecting and viewing the color slides you get, and for displaying color prints and enlargements made from them.

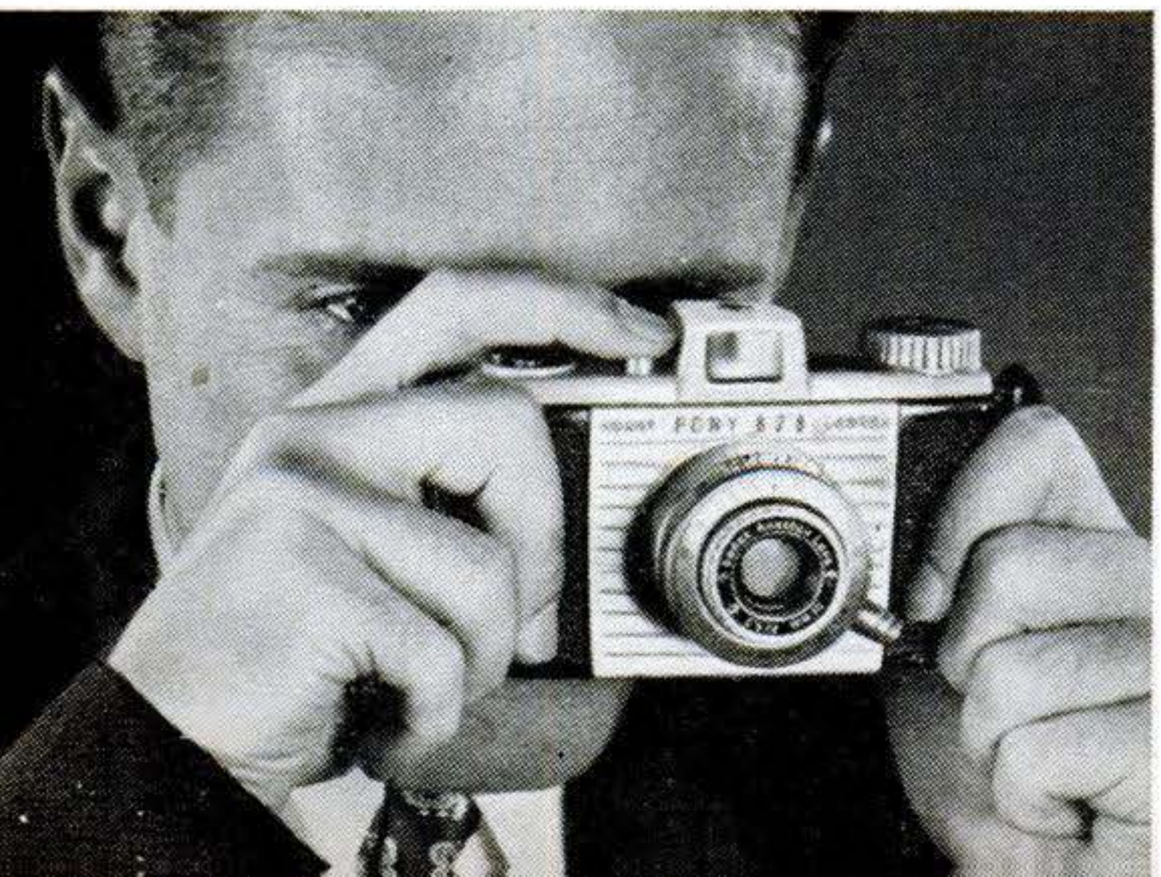
Your dealer will be glad to answer any questions you may have regarding picture taking in color—and to help you choose the right Kodak equipment for getting the most out of color photography. Visit him soon.

Fine, ultra-thrifty "miniature"

The value-packed Kodak Pony 828 Camera makes superb color slides on Kodachrome Film; sharp black-and-white negatives; also gorgeous Kodacolor snapshots. Kodak Anaston *f*/4.5 Lumenized Lens; Kodak Flash 200 Shutter with built-in "synch"; body shutter release. Takes 8-exposure rolls. Only $32; similar "Pony" 135 for 35mm. films, $36.75. Field cases for both models also available.

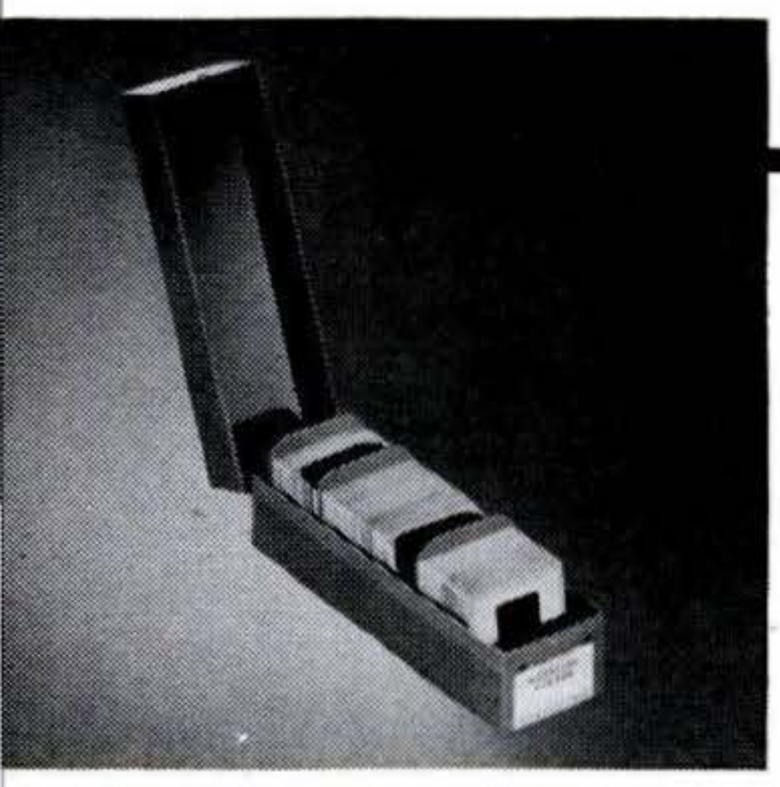
Projects images up to 7 feet wide

Kodaslide Projector, Model 2A, is compact and efficient—costs only $49.50, with Kodak Projection Ektanon Lens, 5-inch *f*/3.5; with 7½-inch *f*/4 lens, $59.50. Slide carrier accepts two transparencies. All optics are Lumenized. 150-watt lamp. You can tilt projector up to 10 degrees. Made of die-cast metal with gray finish. You'll find this model ideal for large home gatherings.

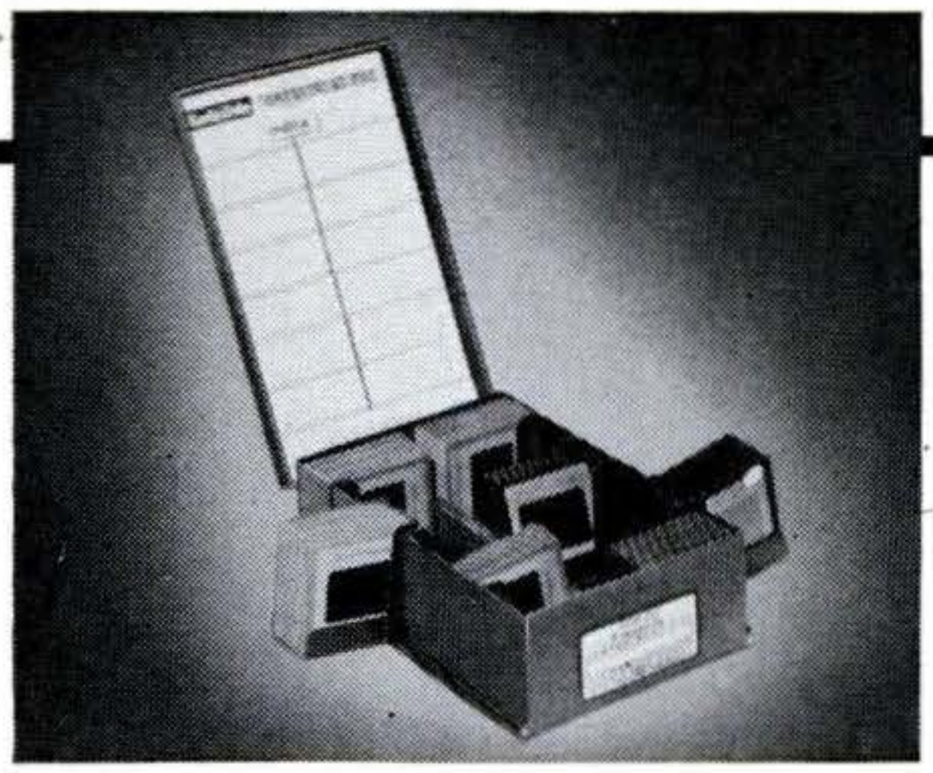


Budget-priced table viewer

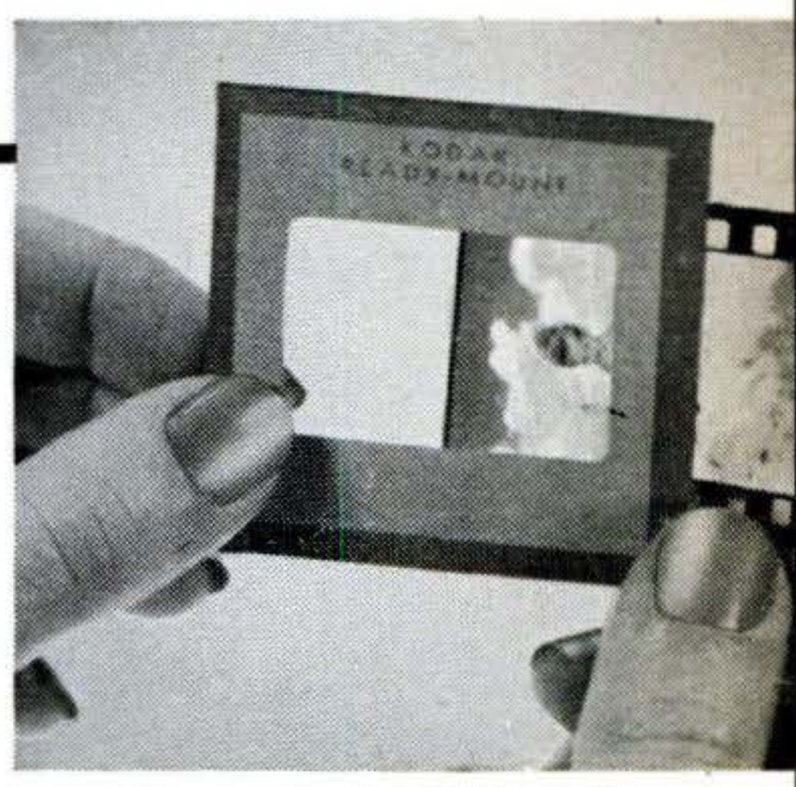
Kodaslide Table Viewer, 4X, combines projector and screen in one compact unit. Here's the *practical, effortless* way to show color slides, enlarged more than four times, to a small group of friends. With the "4X" there's no longer any need to rearrange furniture, no dimming of lights. Just plug it in and you're ready for a color show. Because of the handy on-and-off switch on the eight-foot cord, you can leave the viewer plugged into a wall socket when not in use. Attractively styled to blend with room furnishings. Price, $49.50. Accessory carrying case, extra.



Protect precious slides—Inexpensive metal Kodaslide File Box holds 150 cardboard or 53 glass slides—keeps them organized. $1.50.

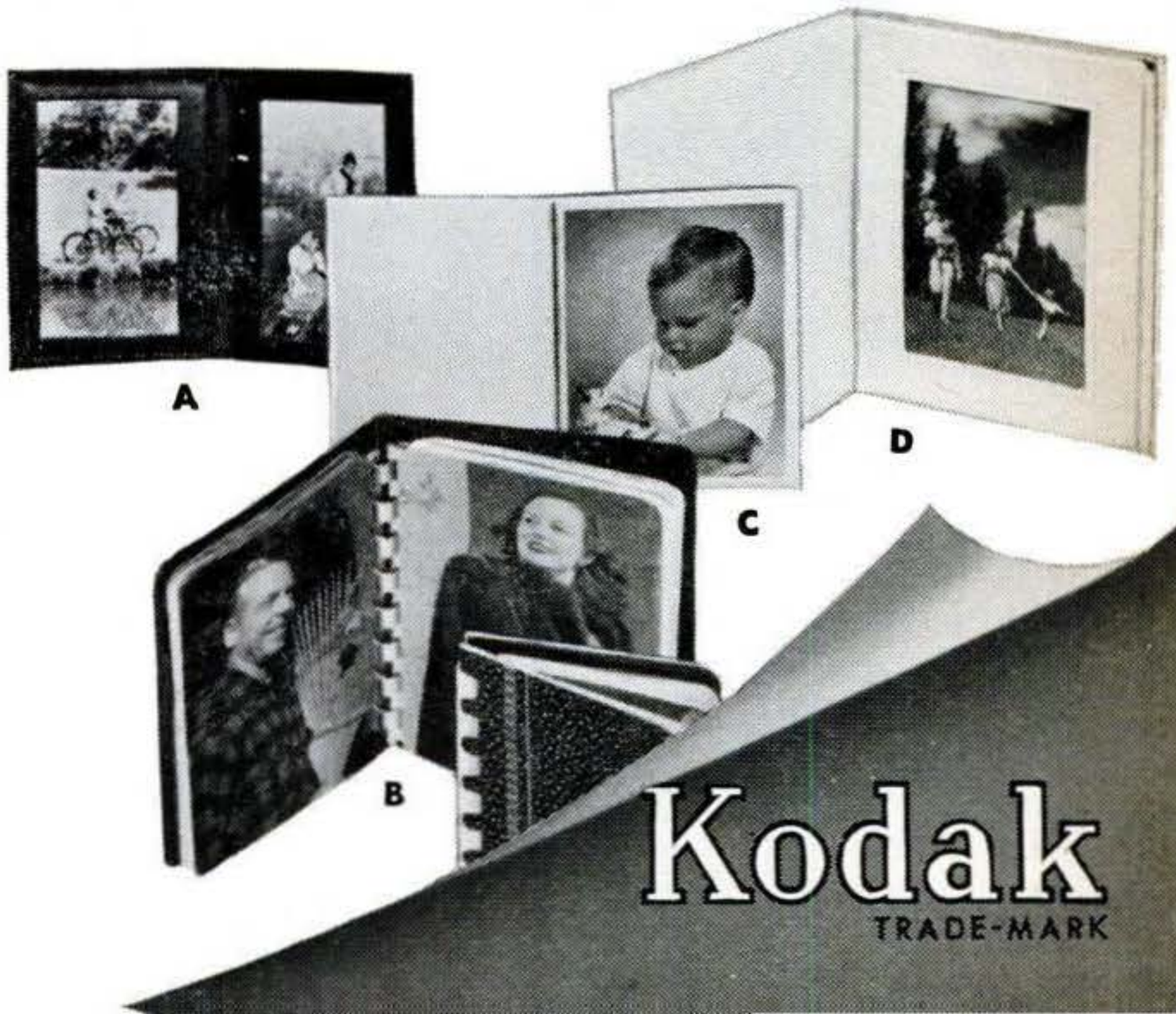


De Luxe file—Kodaslide Compartment File has 12 swing-out compartments, for 240 cardboard or 96 glass slides. Contains handy index inside cover for listing slides by subject. $3.75.



Ready-Mounts—Mount Kodachrome transparencies at home with Kodak Ready-Mounts (cardboard). Box of 50, $1.75 (35mm. or Bantam).

Share your color prints—For Kodachrome Prints: *A*, Kodachrome Print Wallets. For Kodachrome or Kodacolor Prints and Enlargements: *B*, Kodak Color Print Albums; *C*, Kodak Color Print Mounts. For Kodachrome or Kodacolor Prints: *D*, Kodak Color Print Folders. Protect your Kodak color prints and enlargements, and make it easy to share your enjoyment of them with family and friends. Prices start at 10¢.

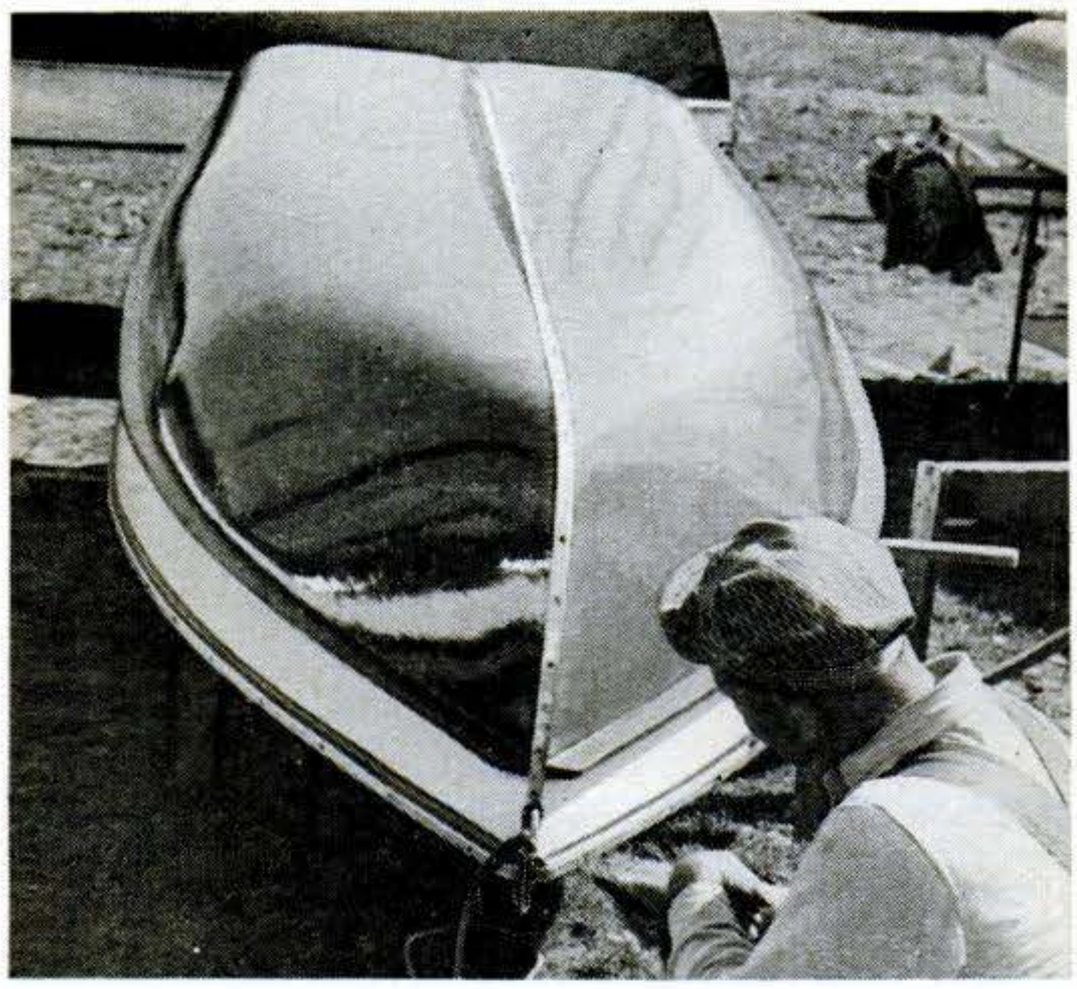


Prices subject to change without notice and include Federal Tax where applicable. Consult your dealer.

EASTMAN KODAK COMPANY,
Rochester 4, N. Y.

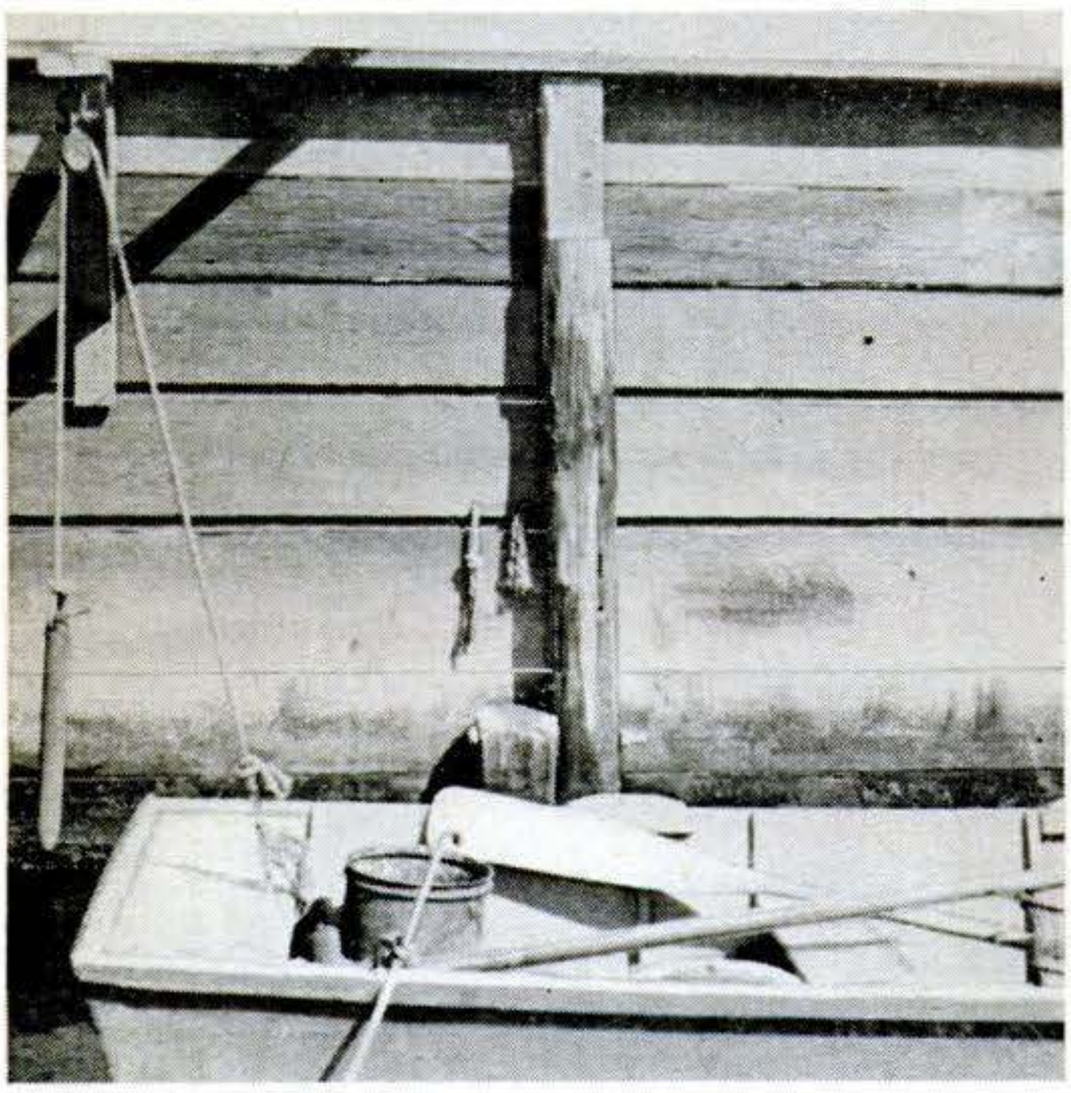
Kodak
TRADE-MARK

Metal Molding Protects Boat



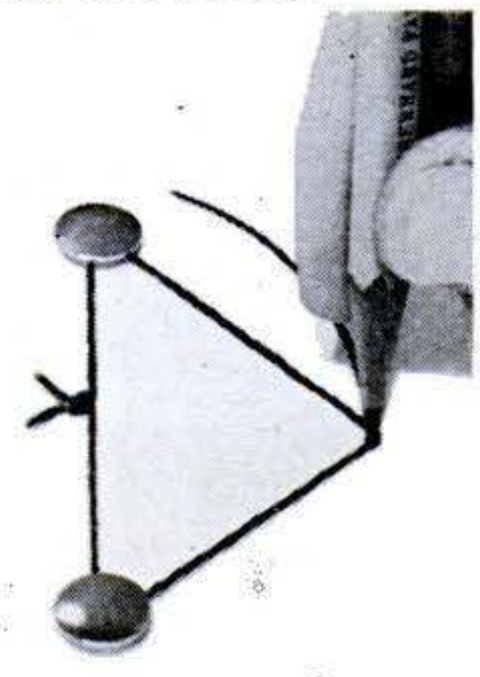
KEELS of small boats frequently are damaged by hitting floating debris or by scuffing when the boat is beached. Such damage can be avoided by covering the keel with the aluminum or stainless-steel molding used as linoleum trim. Molding will also keep the splash rails, chines, and gunwales from being scarred.—*Grover Brinkman, Okawville, Ill.*

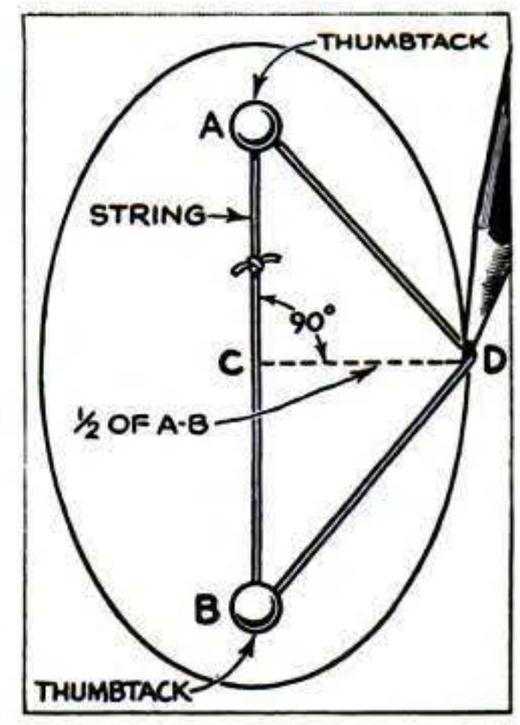
Window Weight Secures Moored Boat



MOOR your boat like this and it won't be rubbed against the dock by the rise and fall of tides or the motion of waves. The bow line is tied to the dock. The stern line runs through a pulley that is bolted to the end of a strut sticking out from the dock. On the end of the stern line is a window weight. As the boat rises or drops with the tide, the weight keeps the line tight and stops sideways drift.—*Elon Jessup, Woods Hole, Mass.*

String Traces Oval Portrait Mask

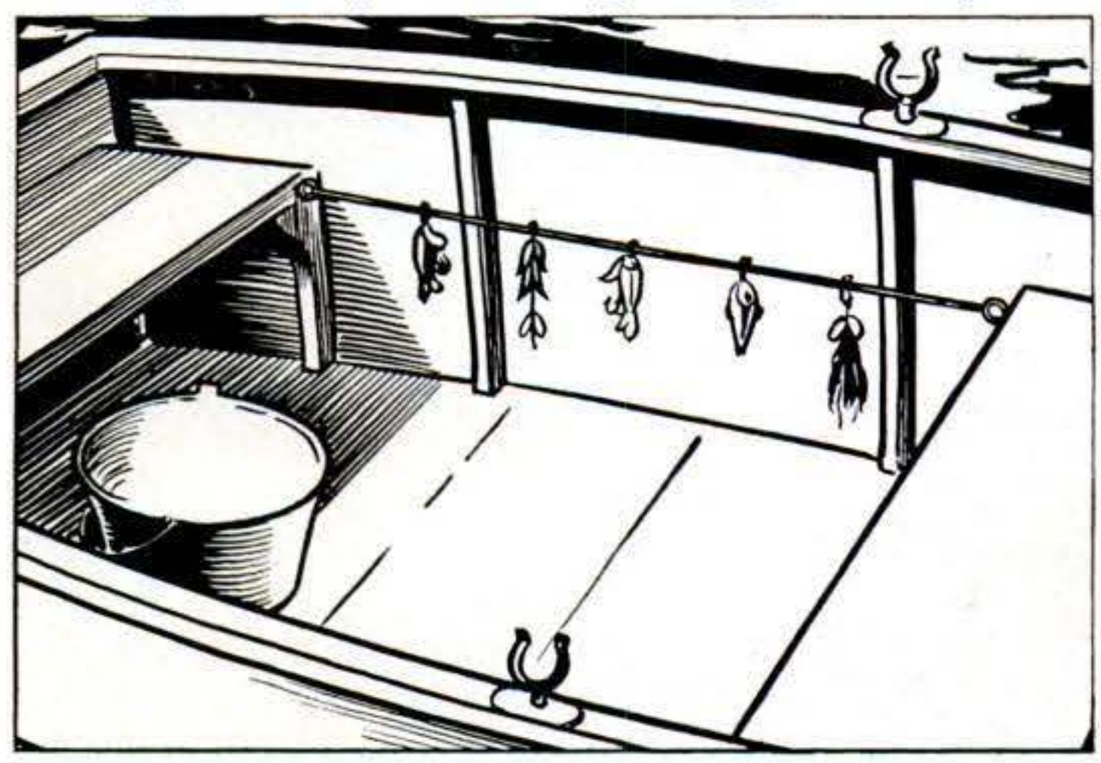




OVAL photographs add variety to an album. Small portraits for a billfold are also attractive in this format. But the oval masks that make them aren't easy to cut freehand. Here's how to trace an oval.

Lay out line AB on black paper. Its length sets the major axis of the oval. From its middle point (C), draw line CD, making it half the length of AB. Insert thumbtacks at points A, B, and D and tie a cord around them. Remove tack at D, place a pencil in the string, and move it around the two tacks, keeping the tension uniform. Then cut on the pencil line.—*John J. Rea, Urbana, Ill.*

Hanger Keeps Fishing Plugs Handy



IF YOU like to change plugs frequently, here's a way to keep them handy. Thread screw eyes into two seats or seat braces and run a piece of wire between them. Hook your plugs on the wire. They're easy to see and the ones you've used will dry quickly.—*John Krill, North Lima, Ohio.*

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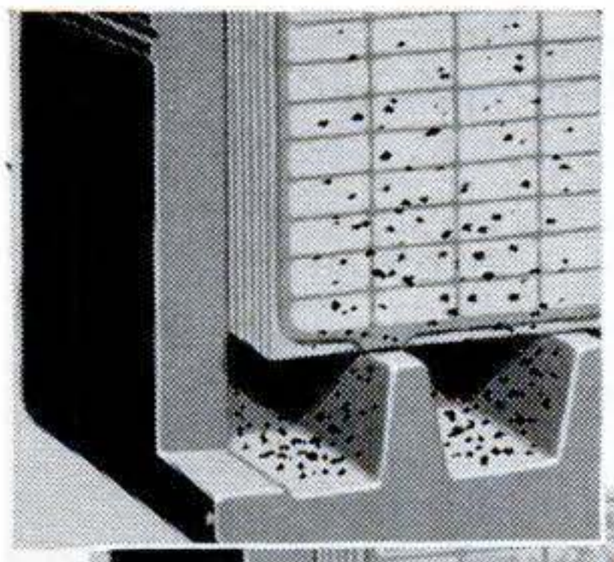
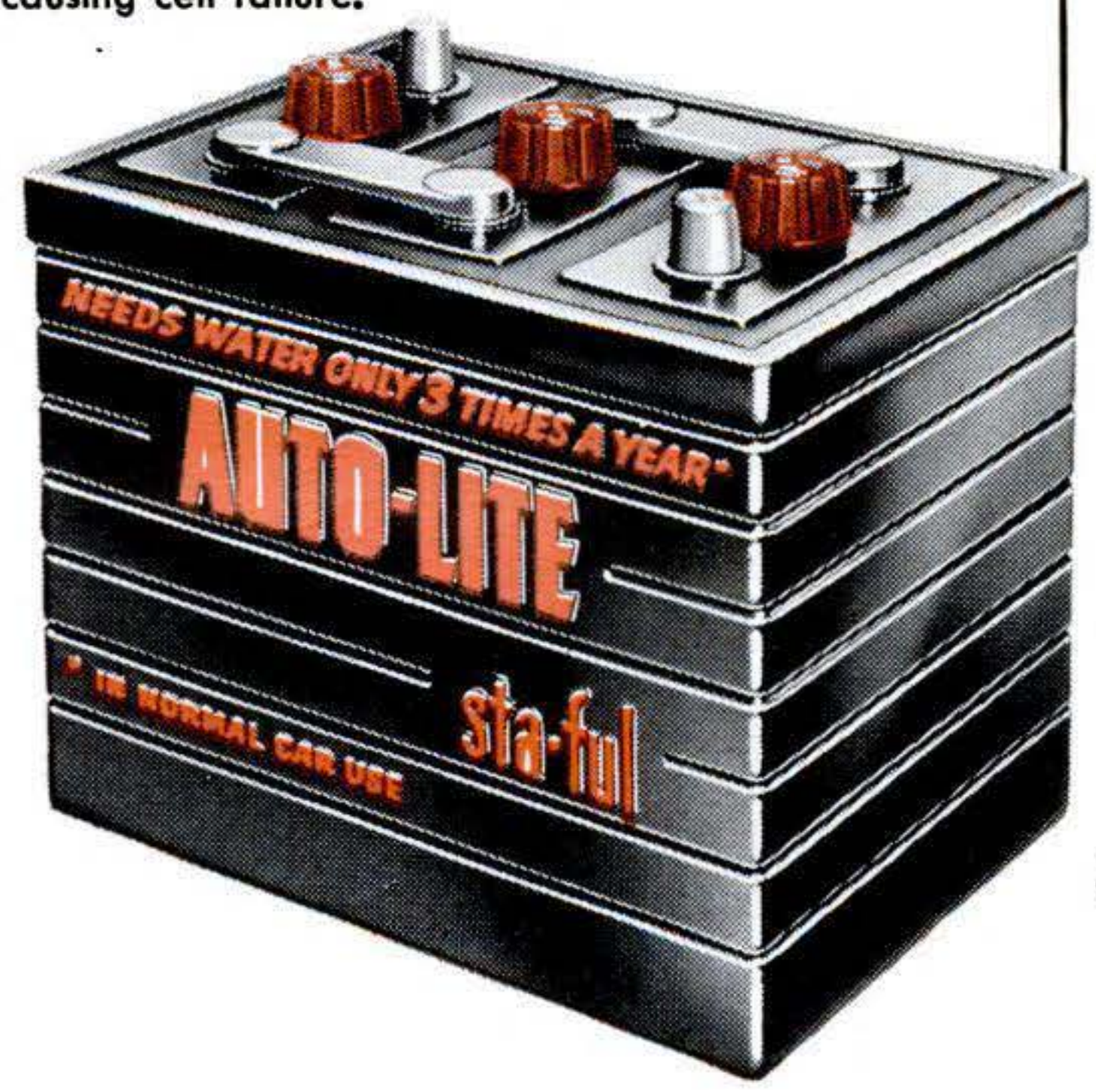
The inside story of your battery-

See how it works!

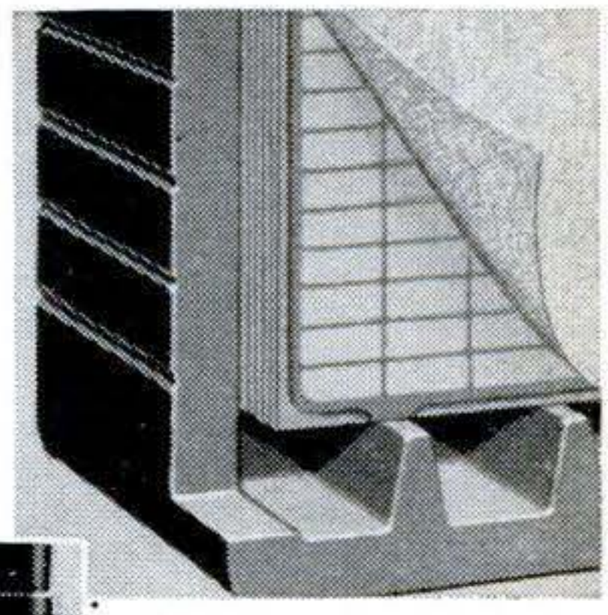


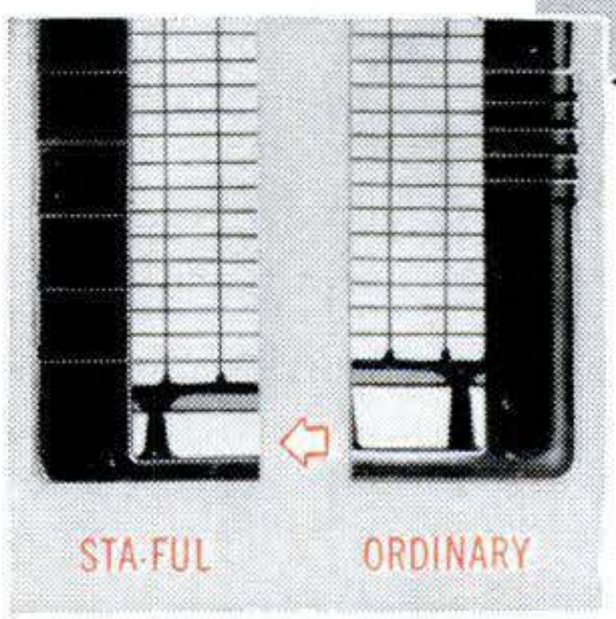
1 In ordinary batteries, small particles keep flaking off positive plates, so ordinary design batteries must have large sediment wells at bottom of case to hold these particles.

2 If sediment wells in ordinary design batteries aren't big enough to hold flaking particles from positive cells, particles pile up and short circuit cells, causing cell failure.

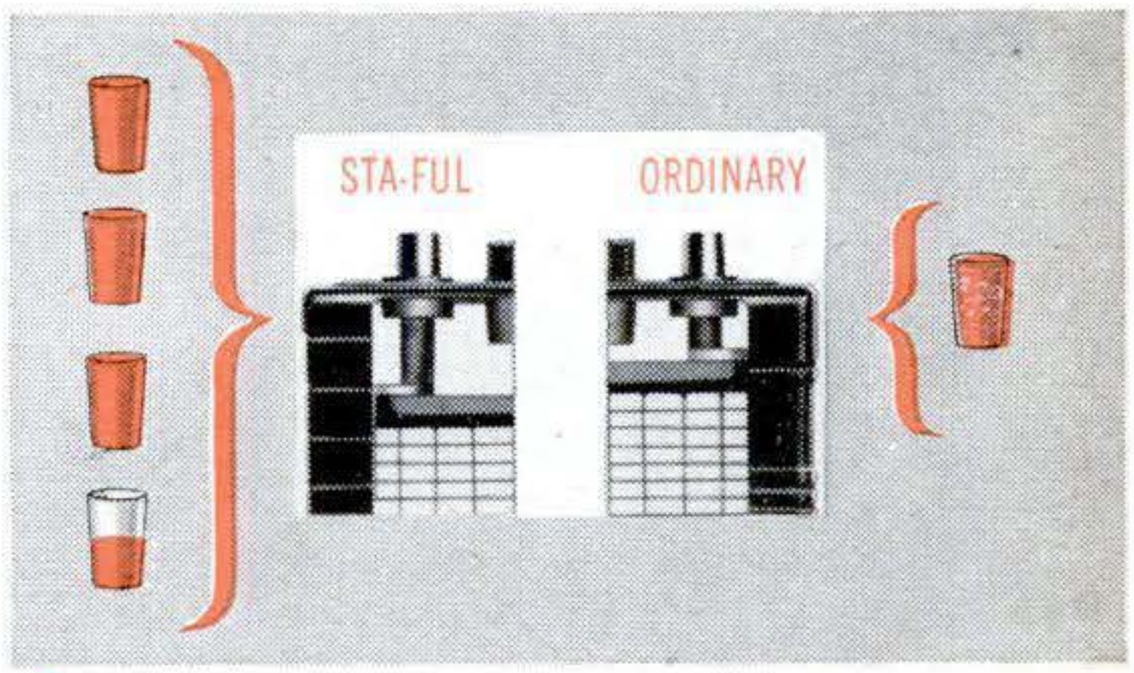


3 In the Auto-Lite "Sta-ful" Battery, every positive plate has a Fibreglass retaining mat protecting it and holding the active materials in place to reduce shedding and flaking.





4 Side-by-side view shows that the "Sta-ful" Battery doesn't need all the extra space at bottom as ordinary design batteries do. So extra space in "Sta-ful" Battery is moved to top where . . .



5 . . . extra space can be used to hold more battery electrolyte, giving room for *over 3 times the liquid reserve* in the "Sta-ful" as in ordinary batteries. That's why the "Sta-ful" needs water only 3 times a year in normal car use. "Sta-ful" Batteries give longer life, too, in tests conducted according to minimum life cycle standards.

AUTO-LITE BATTERY CORPORATION
Toledo 1 **Ohio**

Auto-lite sta-ful *...needs water only 3 times a year*

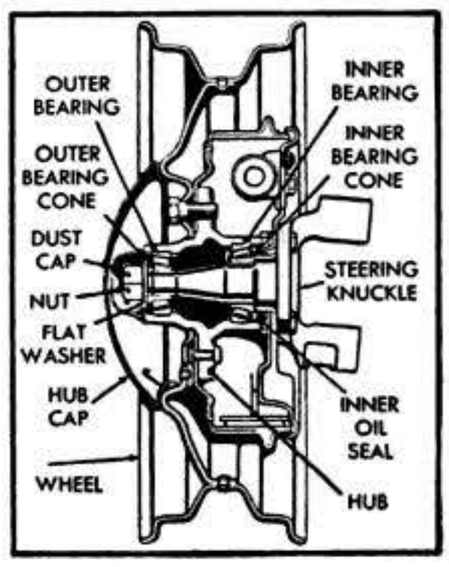
IN NORMAL CAR USE

Copyrighted material

Care and Feeding of Engines BY S. P. CORP

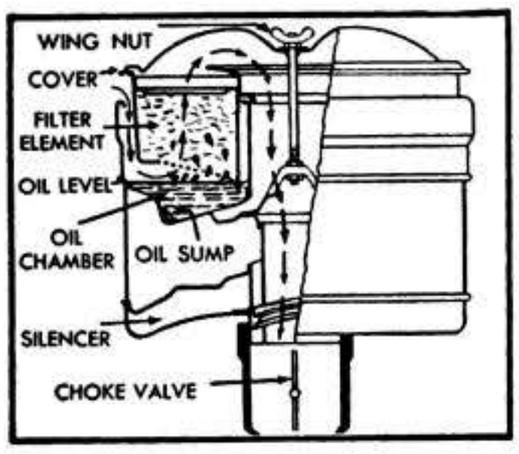
COOL BEARINGS IN SUMMER HEAT

Lubrication of front wheel bearings every 10,000 miles is sometimes neglected with sad consequences. It's not a hard chore to remove a front wheel, clean, grease and replace—but remember these points. Have a new inner oil seal and new cotter pin for replacement. Clean the bearings with gasoline and allow to dry but DON'T spin a dry bearing. Inspect bearings and cups for chipping, flat spots or for overheating—indicated by a dark blue ball or roller. Work about a tablespoon of wheel bearing lubricant into each bearing with your fingers.



Tighten nut till you feel a binding on wheel rotation, then turn one revolution to seat bearing and back off wheel nut until bearings are slightly loose. Retighten nut until looseness is just removed. Install your new cotter pin.

CLEANING AIR CLEANERS



Oil bath air cleaners need service every 5000 miles, others every 2000 miles. If used on dusty roads, clean them twice as often. Oil should be replaced with SAE50 for hot weather and a lighter oil for winter. A dry cleaner unit should be plunged up and down in clean gasoline or kerosene, taking care not to wet the felt at the top of the cover.

IF YOUR CAR DRINKS TOO MUCH

An engine that uses too much oil needs new Sealed Power piston rings. The Sealed Power MD-50 Steel Oil Ring does the world's best job of oil control, even in badly tapered and out-of-round bores. Your dealer has Sealed Power Rings or can get them for you. They save gas, save oil, restore original power to your engine and lengthen its life. A postal to "Sealed Power, Dept. H-8, Muskegon, Mich." will bring you free a helpful book, "7 Ways to Save Oil."

This Bus Rolls Through the Sky

[Continued from page 117]

air-brake tanks to fall below 50 pounds, the brakes automatically stop the car. There is also an auxiliary hand brake. And should a bus be stranded somewhere along the aerial route, the luggage rack holds a block and tackle and bosun's chair for lowering passengers to the ground.

Tramway Insured for $1,000,000

None of these emergency facilities has yet had to be used. A. L. Greenwalt, manager of the Mount Hood Aerial Transportation Company, points out that $1,000,000 worth of liability insurance was obtained "before we ever ordered our first ounce of materials."

Originally, winter was expected to be the big season for this bus that invades the heavens. Mount Hood is the most popular ski resort in the Pacific Northwest. But the skiers were only a one-way haul, at 75 cents each for the uphill ride. They swooped back down on their hickory slats. The bus returned empty.

"Summer tourists are a better paying proposition," says Greenwalt. "They make the full round trip in our bus. And, believe it or not, they have bigger appetites than the skiers and give more business to our restaurants."

Designing and erecting the Mount Hood skyway was the task of the Pointer-Willamette Company of Portland, Oregon, makers of aerial tramways for logging.

Long Lift Required New Technique

At first, the Mount Hood undertaking was to be patterned after the lifts at Franconia Notch and Sugar Loaf Mountain. This meant that the cable would provide the traction. Engineers finally vetoed the scheme. Franconia Notch is only a one-mile tram, but they were dubious about a moving cable more than three miles in length. The engineers also pointed out that the car at Franconia Notch is a light shell constructed like an elevator. It offers standing room only. Mount Hood needed a heavier, more spacious vehicle.

The busses were literally handmade. No phase of the Mount Hood project was more ticklish than this. Each coach cost $40,000, as contrasted with $16,500 for an ordinary bus of the same horsepower. Because the equipment cannot be turned

[Continued on page 214]

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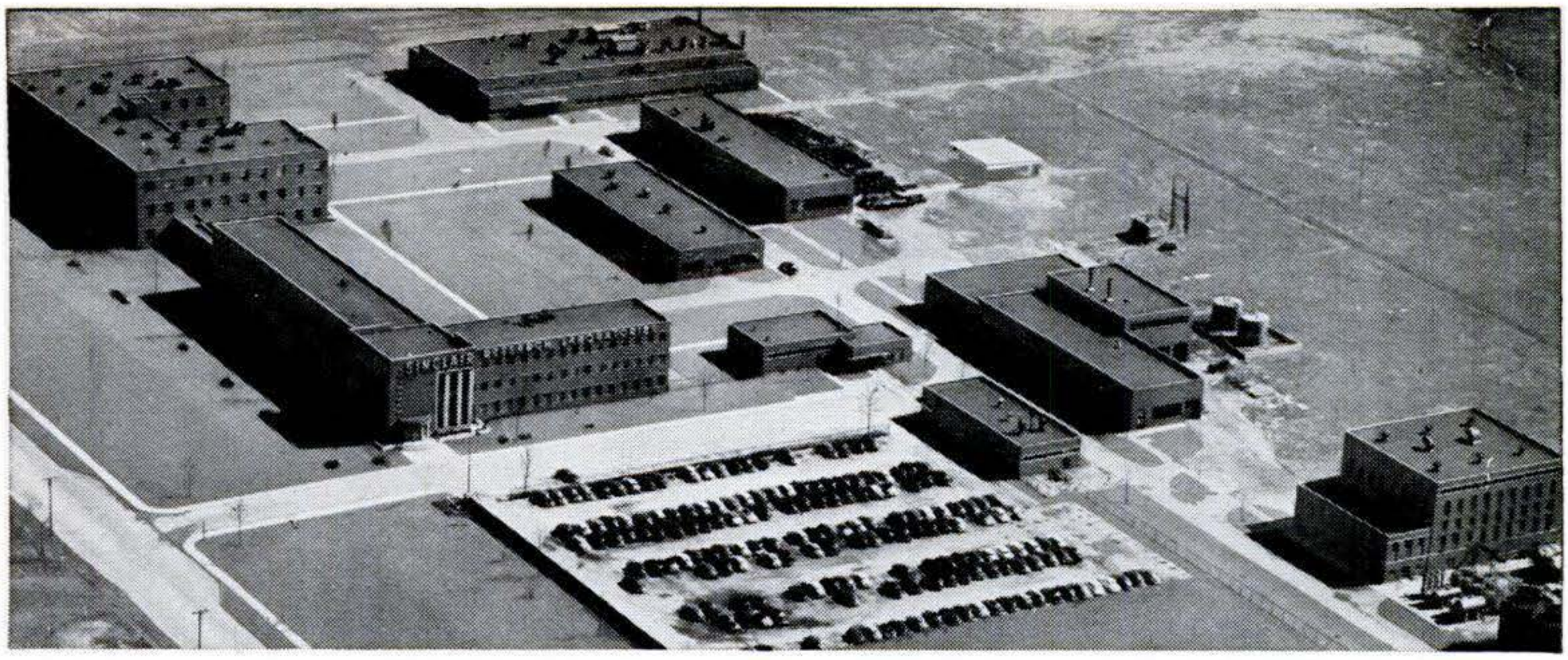

SINCLAIR RESEARCH LABORATORIES—nine buildings containing the most modern testing equipment known—have contributed many of today's most important developments in petroleum products, production and refining. Under the Sinclair Plan, the available capacity of these great laboratories is being turned over to work on the promising ideas of independent inventors who have no such facilities within their reach.

An Offer of Research Facilities To Inventive Americans Who Need Them

The Sinclair Plan is opening up the Company's great laboratories to every American who has an idea for a better petroleum product

INVENTIVE Americans are often at a loss today. Not because of any lack of ideas, but because of a need for large and expensive facilities to find out if and how their ideas work.

This was no obstacle in our earlier days. The Wright Brothers designed their first airplane with the help of a foot-square homemade "wind box"—and the plane flew.

In contrast, the man with a new idea in airplane design today often needs a supersonic wind tunnel costing millions.

In short, science and invention have become so complex that a man with an idea for a better product often needs the assistance of an army of specialists and millions worth of equipment to prove his idea has value.

Within the petroleum field, the Sinclair Plan now offers to provide that assistance.

Under this Plan, Sinclair is opening up its great research laboratories at Harvey, Illinois, to independent inventors who have sufficiently good ideas for better petroleum products or for new applications of petroleum products.

If you have an idea of this kind, you are invited to submit it to the Sinclair Research Laboratories, with the provision that each idea must first be protected, in your own interest, by a patent application, or a patent.

The inventor's idea remains his own property

If the directors of the laboratories select your idea for development, they will make, in most cases, a very simple arrangement with you: In return for the laboratories' investment of time, facilities, money and personnel, Sinclair will receive the privilege of using the idea for its own companies, free from royalties. This in no way hinders the inventor from selling his idea to any of the hundreds of other oil companies for whatever he can get. Under the Plan, Sinclair has *no control* over the inventor's sale of his idea to others, and has *no participation* in any of the inventor's profits through such dealings. Moreover, it is a competitive characteristic of the oil business that the new products adopted by one company are almost invariably adopted by the whole industry. This means that the very fact of his agreement with Sinclair should open up to the inventor commercial opportunities which might otherwise be hard to find.

How to proceed: Instructions on how to submit ideas under the Sinclair Plan are contained in an Inventor's Booklet available on request. Write to: W. M. Flowers, Executive Vice-President, Sinclair Research Laboratories, Inc., 630 Fifth Avenue, New York 20, N. Y. for your copy.

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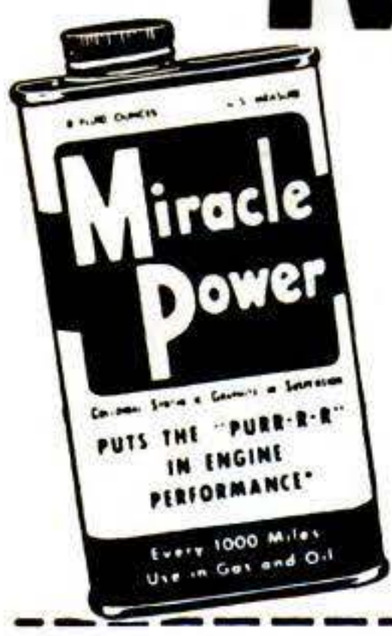

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This Bus Rolls Through the Sky

[Continued from page 212]

around, there are identical operating levers and control panels at each end of the coach. Going downhill, the bus uses compression to retard speed. On the steepest of the uphill grades, the driver shifts to low gear.

Approximately seven gallons of high-octane fuel are required for a round trip. The State Highway Commission exempts the Mount Hood tramway, however, from the Oregon gasoline tax of six cents a gallon. After all, no bus of 24,000 pounds ever was easier on the state's roads.

Driver Has Tricky Job

It takes ordinary bus drivers at least six weeks to become expert at operating these busses in the clouds. Trickiest aspect of the driver's job is taking the coach through the "jacks" or cable supports at each tower. The weight of the heavy car makes the incline extremely steep where the cable passes through the towers. Yet it is not feasible to speed up and gain momentum for the grade, for the coach must cross each jack slowly to avoid a jarring bump.

The towers "float" on pivots, so they will sway from four to six inches with the passage of the heavy car. A rigid upright might be in danger of buckling under the stress.

When the bus ends its ascent, it is still a full mile in elevation below the glacial summit of Mount Hood. Will the route ever be extended to the top? That is the question asked most often by eager tourists. The last 1,000 feet of Oregon's loftiest crag are almost perpendicular. While engineers believe the sky-going bus could make this grade, they look askance at the possibility of heavy sheaths of ice that might snap the cables.

Can't Spoil Mountaineers' Fun

And there is another obstacle. The region has a celebrated Alpine club known as the Mazamas, a name taken from the Indian word meaning "mountain goat." Hopeful human mountain goats can qualify for membership in the Mazamas only by gaining the summit of a peak that has a "living glacier" on its ramparts. Mount Hood is where this goal is most often achieved. And now the Mazamas have notified the owners of the tramway that they will carry the issue to Congress before they allow their mountaintop to be reached on leather cushions! END

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LOUIS MEYER
Winner 1928
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FRANK LOCKHART
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PETER DE PAOLO
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JOE BOYER
Co-winner 1924
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L. L. CORUM
Co-winner 1924
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TOMMY MILTON
Winner 1921
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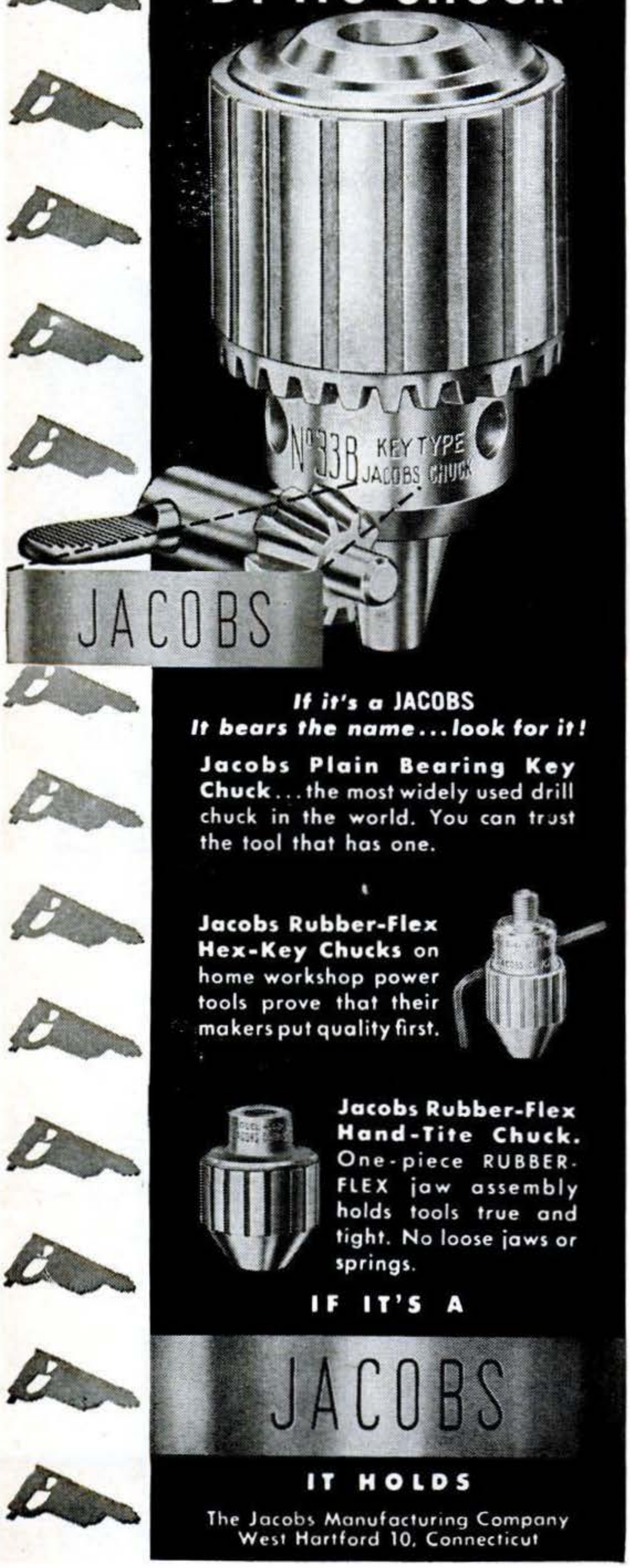

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IF IT'S A
JACOBS
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Gus Answers a Night Call

[*Continued from page 160*]

of the fan belt and then began turning the fan by hand. Finally he reached into the side pocket of his coveralls, pulled out a screwdriver, and pointed to a dark spot on the inner groove of the fan pulley.

"I think just maybe that might be our trouble," he said, digging at the spot with the tip of the screwdriver. "Feels like greasy dirt," he added, after he had scraped some off and rubbed it between his fingers.

When Gus had cleaned the fan pulley, he told Ted to start the engine. Both men listened, but there wasn't a chirp.

"That's got it," grinned Gus. "Every time your fan belt hit that greasy spot, it slipped a bit and let out a squeak."

When Ted had driven off, Gus turned to Stan. "Well, one down, one to go. At least we're batting .500."

"I don't get it," said Stan. "I checked the generator brushes like you said, and they're all right, too. What's left?"

Gus looked at his watch. "Well, it's getting on to noon and you probably have something better to do with your Saturday afternoon than chasing after noises. Why don't we give it up for now?"

Stan Joins Song Fest

"That's just it," said Stan glumly. "Jane and I were planning to go to the beach this afternoon, and she'll be here in a few minutes to ride out with me."

"I get it," winked Gus, "if you don't get rid of the noise, she'll get rid of you. Well, if we can't find out *what* it is, let's see if we can find out *where* it is."

As Stan started up the engine again, Gus cupped his hands around an ear, like a funnel, and began moving his head slowly along the side of the engine.

Intrigued by what Gus was doing, Stan began unconsciously to whistle a tune.

Gus's patience collapsed like a punctured tire. "For Pete's sake, Stan, how can I hear anything if you're going to—"

Suddenly Gus straightened up. "Hey, wait a minute. Stan, we've been a couple of chumps!"

Stan's expression had made a fast change from wounded vanity to abject apology to utter amazement and had now come to rest completely blank.

"No wonder we didn't recognize that noise," Gus went on. "It isn't a screech like

[*Continued on page 218*]

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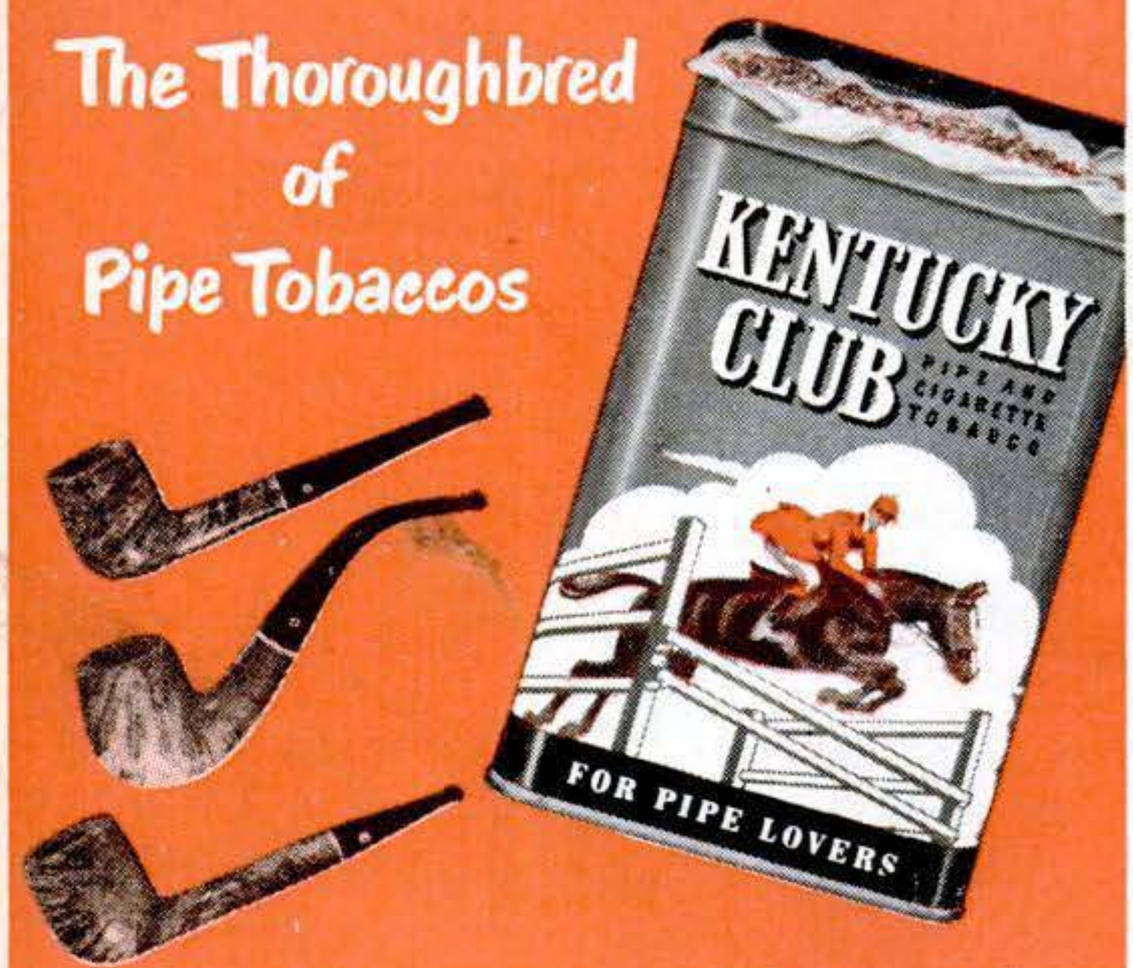

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Gus Answers a Night Call

[*Continued from page 216*]

two metallic surfaces rubbing together. It's a whistle, like air rushing through a hole."

Quickly Gus checked the vacuum line to the windshield wipers, but the hose was sound and the connections tight. Then he reached for the air cleaner. It wobbled. As he held it, the whistle stopped, then when he let go, it started again.

"That's it," Stan shouted, "the air cleaner's loose."

"No," corrected Gus, "the whole carburetor's loose. Get me a wrench."

Stan brought the wrench and Gus fitted it to one of the studs that held the base of the carburetor to the intake manifold.

"This one's loose," said Gus, as he tightened it. And as he did so the whistle became fainter.

"Now let's try the one on the other side."

When he pulled that one up tight, too, the whistle disappeared completely.

"Well, that's one for the books," exclaimed Stan. "The looseness of those studs allowed air to be sucked in between the base of the carburetor and the intake manifold and caused a whistle."

Gus nodded.

Air Quiets Own Noise

"But how come the whistle was louder at low speeds?" asked Stan. "You'd think that when you opened her up more air would be pulled in through the leak and the whistle would get louder."

Gus rubbed his chin thoughtfully. "Probably what happened was that the bigger masses of air at high speeds were strong enough to seat the carburetor base a little better and cut down the leakage."

As Gus finished explaining, there was the sound of high heels outside the garage, and the two looked up to see the pretty young figure of Jane Stevens standing in the doorway. "Hi, Stan. Hello, Mr. Wilson. Am I too early?"

"Just in time," declared Gus. "I don't know about Stan, but this is the last time this thing will whistle at anybody!"

"We don't have to worry any more about waking up your father," put in Stan excitedly, "like we nearly did last night."

"Oh," exclaimed Jane, "I almost forgot to tell you. After we left for the dance last night, Dad drove over to Townsville to some business convention and stayed overnight. He wasn't home at all." END

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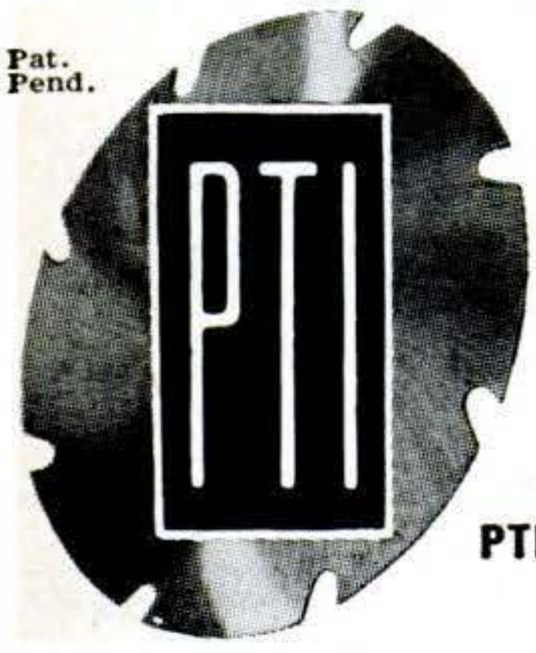

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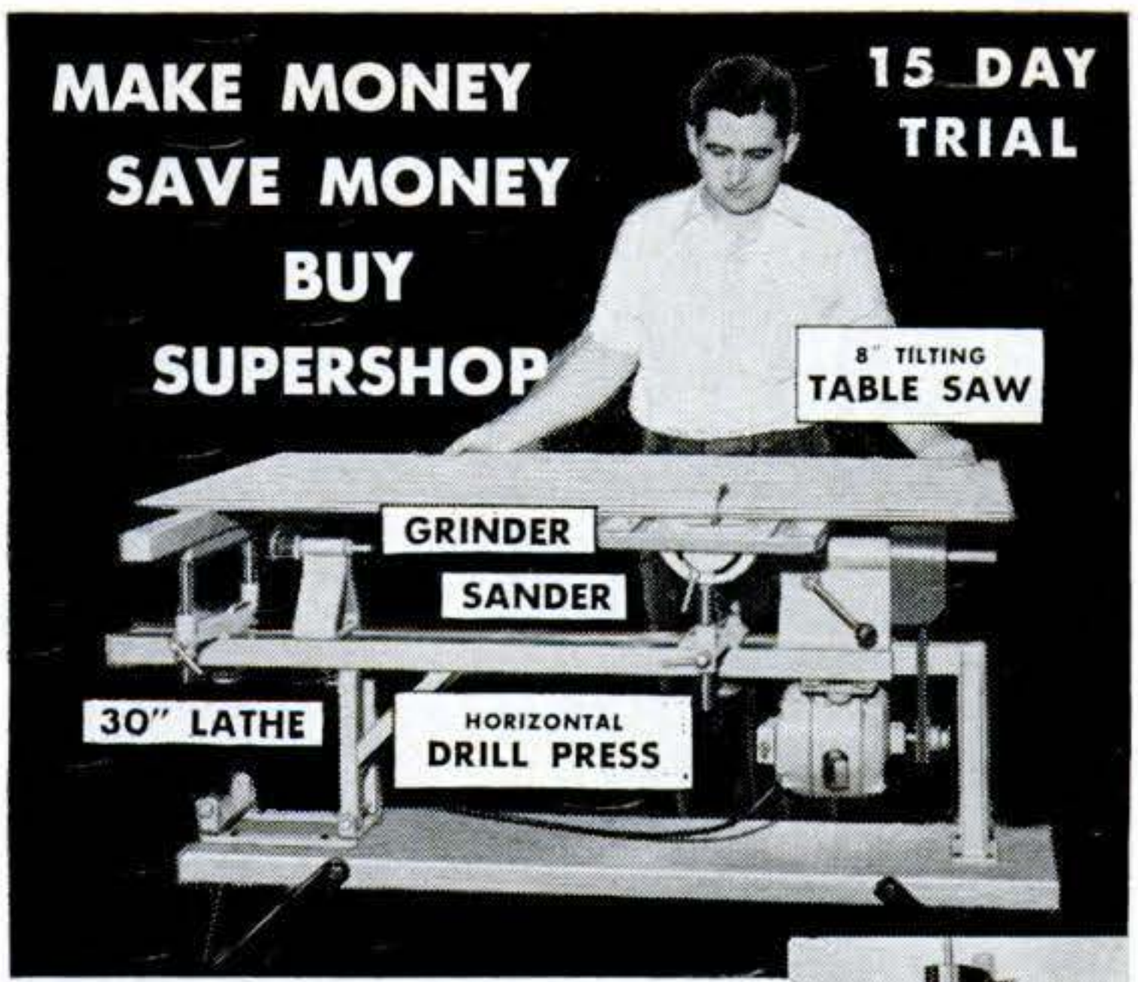

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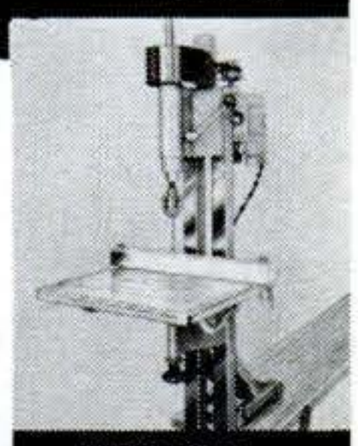

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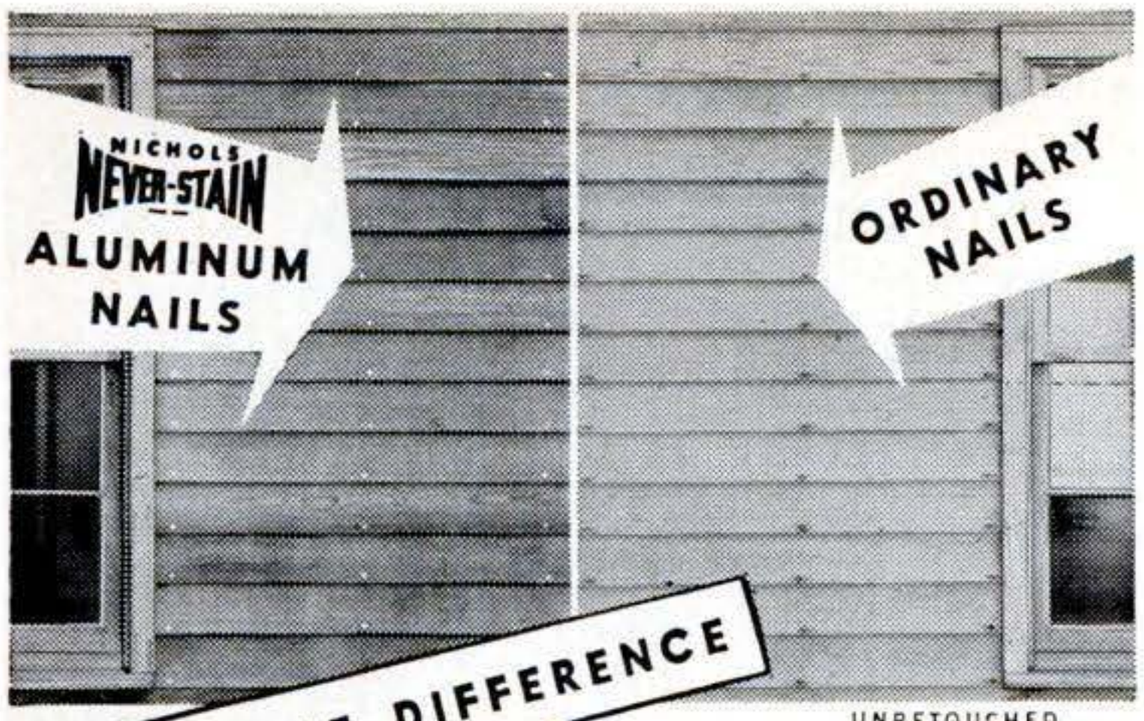

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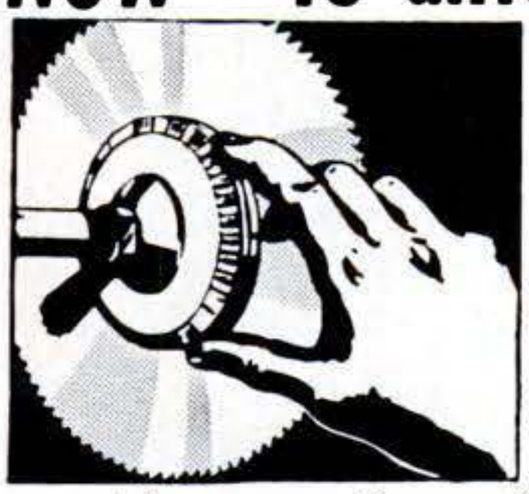

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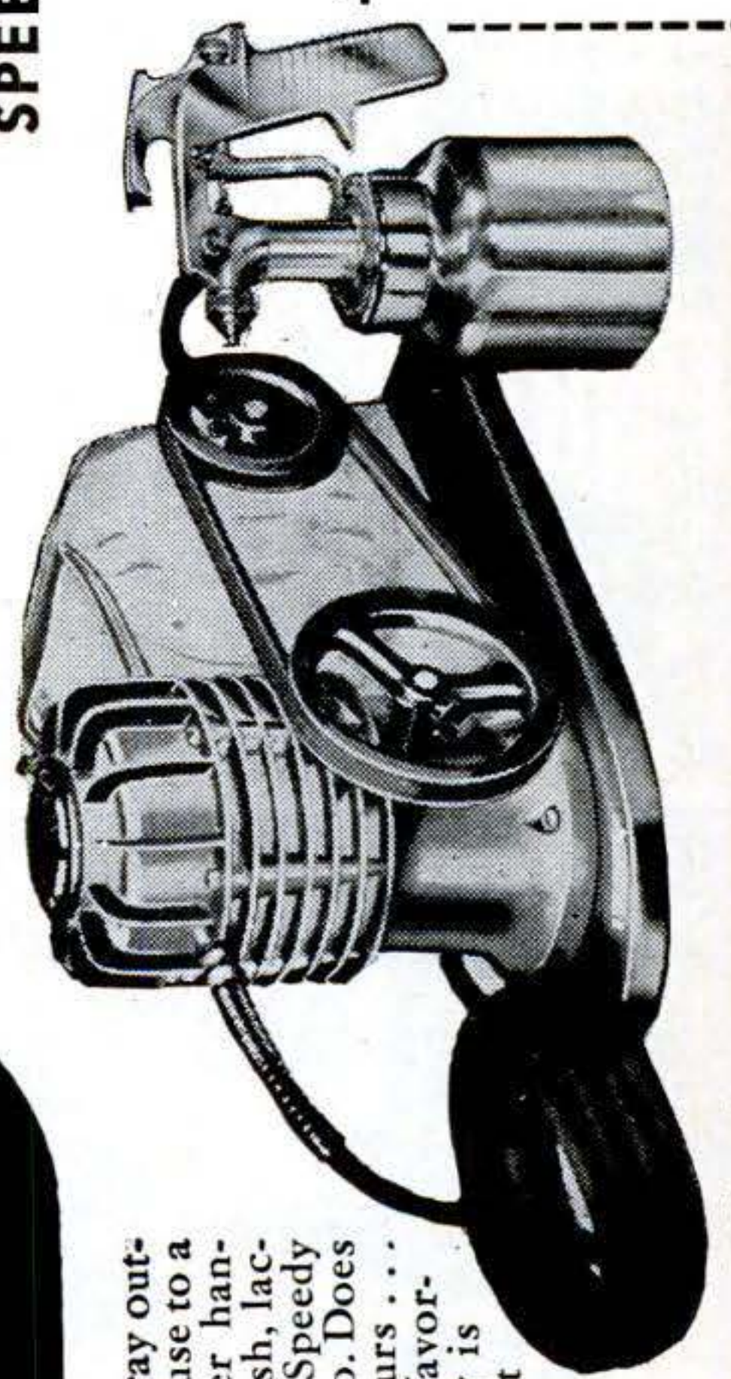

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The Boy Who Grew Flying Bananas

[*Continued from page 132*]

auxiliary jet adaptations in the offing), the XH-16 is expected to fly faster, farther, with heavier loads, than any previous rotary-wing craft.

To turn all these out as fast as the services want them, while other workmen extend plant space in three directions, is only a headwind to whet the bite of Frank Piasecki's mental rotors. He has fitted up a shower and bunkroom next to his office so as to be everywhere on both shifts, working well into the night.

And for once, the military seems to share his enthusiasm. The Army Field Forces envision helicopters as highly mobile firing platforms for attacks on enemy tanks and gun emplacements with rockets and recoilless weapons. The Navy is playing around with the same idea for submarine hunting. And when men of all services contemplate future beachheads on the order of Omaha, in an age of atomic anti-personnel bombs . . .

Helicopters Have Peacetime Uses, Too

Frank Piasecki would be the last to dispute the theory that "heliheads" may replace beachheads. But Frank already is looking forward to the time when, like the curly dark-brown thatch on his high forehead, Mars will retreat. And he thinks peace this time will really bring the helicopter into its own. He can (and does) reel off facts and figures to prove it.

Helicopters cost about the same as planes ($10,000 a seat). Operating costs are roughly the same. Meanwhile, airplanes need airports. With the coming of jets, runways will have to be longer, therefore even farther from urban centers. If you figure in downtown-to-airport, ground maneuver, air maneuver, air maneuver at destination, and airport-to-downtown, the 120-m.p.h. helicopter will cover 350 door-to-door miles in the same time it takes a 300-m.p.h. plane.

And then there are the vast stretches of the earth (about four-fifths of its total surface) where there are no airfields, no railroads, often no roads. Here, the helicopter is the *only* means of transportation (other than the burro) that does not involve a lot of money for something besides the carrier itself.

That is the modest, practical, but potentially big piece of the transportation pie Frank Piasecki sees for his baby. END

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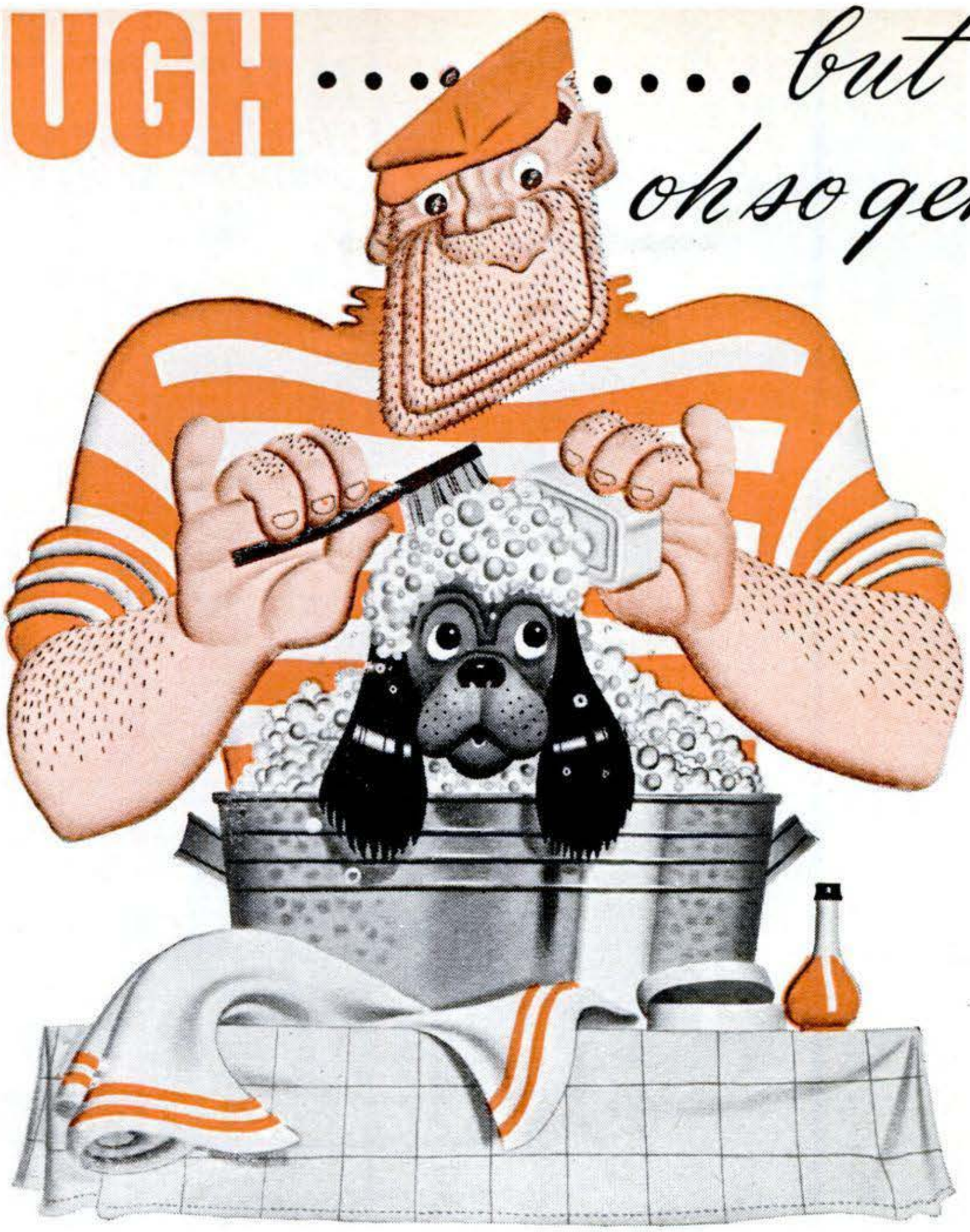
TOUGH . . . . . *but oh so gentle*



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JOIN THE THOUSANDS who SAVE WORK — SAVE TIME and do the job BETTER with "ARCO-SAW"

(Over 100,000 Sold)

AT BETTER HARDWARE STORES EVERYWHERE

9.95 Pat. Pend.

No. 444 "ARCO-SAW"

'ARCO SAW'

CAN BE USED WITH ONE HAND! *Any 1/4" or 3/8" Drill a Powerful Saw in ONE MINUTE* "ARCO-SAW" is a rugged tool with **right angle gear drive** (no clumsy, dangerous, direct drive with drill sideways). Works like a high priced Portable Saw.

CUTS 1-5/16", or 2x4 by turning over

ONLY *ARCO* GIVES YOU ALL THESE FEATURES: **Safety-yoke** assures rigid connection and **absolute safety—Visual guide and wide shoe-plate** for straight, square cuts—**Big handle** affords firm grip for two-hand operation—**Precision one-piece** gear box—**Self-lubricating** lifetime bearings.

NOW AVAILABLE! No. 445 "ARCO-SAW" 11.50 for DEPTH & BEVEL CUTS

Has all Features Listed Above Plus: **Depth gage** with graduated adjustment from 0 to 1¼" depth (for grooves, dados, scoring), **Bevel gage** with graduated adjustment from 0 to 45° bevel (for dovetails, bevels), **Rip gage** with sideways adjustment (for accurate width molding, strips), **Visual guide** with adjustment to follow lines on both straight and bevel cutting.

NO. 444 "ARCO-SAW," complete with 4-inch "HYCARBON" CROSSCUT BLADE (less drill) . . **$9.95**

NO. 445 "ARCO-SAW," complete with Depth-Bevel-Rip Gage and 4-inch ARCO "HYCARBON" CROSSCUT BLADE (less drill) **$11.50**

NO. 444G DEPTH-BEVEL-RIP GAGE. Easily attaches to any No. 444 "ARCO-SAW" to convert it to a No. 445 "ARCO-SAW" **$1.95**

"HYCARBON" REPLACEMENT BLADES—4-inch Crosscut or 4-inch Combination **$2.00**

90-DAY FACTORY GUARANTEE

ORDER TODAY at your dealer or send us check or M.O. (Postpaid.) C.O.D.'s, postage extra. Ask for literature of other tools.

UNCONDITIONAL 10-DAY MONEY BACK GUARANTEE

DEALERS—Write for nearest jobber.

ARROW METAL PRODUCTS CO.

DEPT. PS-8, 140 WEST BROADWAY, NEW YORK 13, N. Y.

STOP DRIP

caused from condensation on cold water pipes. Turn idle basement space into play or work rooms. Keep store rooms dry. Just wrap cork-filled No-Drip Tape around pipes and joints. Do it yourself. Clean and easy to apply. Roll covers about 10 feet of 1/2" pipe, $1.69. *Higher west of Rockies and Canada.* Get at Hardware, Department Stores, or sent postpaid. Write for free circular. J. W Mortell Co., 534 Burch St., Kankakee, Illinois.

No Drip TAPE

MILLER ROTARY

HI-SPEED COPE-SAW DRILL-BIT

IT DRILLS IT SAWS IT REAMS

DRILL, SAW, REAM metal, pipe, wood, plastic, Transite, etc. Use with any electric drill, slow drill press, lathe or milling machine Drills own starting hole—upper part of bit is used to cut, saw or ream circles, ovals, squares or scrolls. Easy to operate. Ideal for carpenters, mechanics, electricians, plumbers, hobbyists, many others Abrasive resistant, high speed steel. Flutes ground from solid. Will withstand severe continuous use without breaking. Resharpened at no charge. Takes place of up to $50 in tools. 1/4" diameter, 2" cutting sections, total length 3 1/2" Also available specially designed for wood or metal and in 2 3/8" and 1 3/4" lengths. Write for details. Specify all-purpose bit. Shipped same day. Money-back guarantee Dealer inquiries invited

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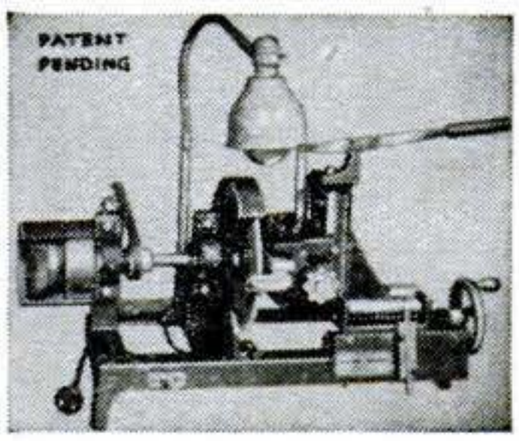
Manufactured and distributed by:

INTERNATIONAL TWIST DRILL CORP.

692 Wyandotte, Rm. Kansas City 6 Mo.

only **$3.95** POST PAID



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or Add to your present Repair Business

SHARPEN DULL PIPE WRENCHES

PIPE TAPS & DIES

"GUM" CIRCULAR SAWS

Write for Information

J. C. MOORE INDUSTRIES

BOX S 276, Fredonia, Pa.

VARIABLE SPEED HYDRAULIC POWER TRANSMISSION

It has Infinite Speeds 0 to 550 Reverse Automatic Overload Protection; Adjustable Torque up to 180 inch pounds. 5/8" Input and Output Shafts. It will handle 1/4 to 1 1/2 H.P. Motor. Case measures 7 1/2" long 7" high 6 1/2" wide. VALUE OVER $300. Shipping Wt. 25#. On C.O.D. Orders we require a 10% Deposit.

only $54.50 Fob. Chicago

DIRZIUS MACHINE SHOP "Q" 1423-25 So. 52nd Ave., Cicero 50, Ill.

Whether you take a defense welding job or start your own shop, there's plenty of big money ahead for you as a trained weldor. Learn now in this modern, non-profit school. Thorough training, best equipment, experienced instructors. Complete or partial courses. Write today.

HOBART Trade School, Box P-81, Troy, Ohio

Save Time!!! Save Money!!!

SEND FOR THIS BIG, NEW

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ONLY **15c**

New low prices...great selection of fine domestic and imported woods...bargains in hard to get supplies--144 pages of items and ideas for woodworkers. Quick delivery on mahogany, walnut, maple, cherry, poplar, oak, red cedar, and others properly seasoned, kiln dried. Send 15c for your copy--TODAY. Dept. B-8

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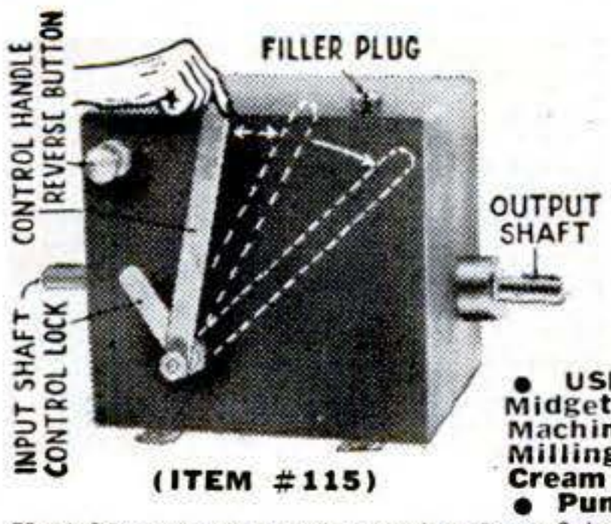

(ITEM #115)

HYDRAULIC SPEED REDUCER

with FINGERTIP CONTROL

• USE FOR: • Reamer Drives • Midget Cars • Feed Mills • Canning Machines • Conveyors • Lathes • Milling Machines • Motor Boats • Cream Separators • Garden Tractors • Pumps

Variable output speeds ranging from 0 to input speed now available. Merely move control handle until desired speed is attained. Then turn locking handle to maintain the setting. Internal relief valves prevent overloading. Use input power of 1/4 to 1 1/2 H.P.
This Westinghouse-Oil Gear Unit converted to commercial use from 40 MM anti-aircraft traversing mechanisms consists of a variable displacement hydraulic pump feeding a fixed displacement hydraulic motor. These components are contained in a crackle-finish steel oil reservoir (capacity 2 qts.). Adjustable relief valves set at factory for 100 inch pounds of torque may be reset up to 180 inch pounds. Independent reverse control allows full output power and speed selection in either direction of rotation. Both input and output shafts measure 5/8" diam., include keyway. Input rotation is counter-clockwise facing shaft. Recommended input speeds not to exceed 750 R.P.M. Over-all dimensions 7 1/2"x7 1/2"x11 1/2". Gov't acquisition cost, $428.00. Shipping weight 31 lbs. Complete with 2 qts. of oil and full instructions. F.O.B. Chicago..... **54.50**

Byron-Jackson "PUP" — $3800.00 Value

CENTRIFUGAL PUMP UNIT

COMPLETE WITH FULL ENGINE AND PUMP INSTRUCTIONS

(Item #132)

2 STAGE MODEL "PUP" PUMP DRIVEN BY AN 8 CYLINDER MODEL C-36 CHRYSLER INDUSTRIAL ENGINE. ENGINE SPEED 2400 RPM—100 H.P.
600 GPM AT 175 PSI— PARALLEL CONNECTION
300 GPM AT 375 PSI— SERIES CONNECTION
IDEAL FOR: Pick-up, Gathering, Fire Fighting, Salt Water Disposal, Sprinklers, Irrigation, Dewatering, Construction, etc.

These skid-mounted Pumping Units are standard production models with parts and service readily available. Designed for a wide range of operating conditions particularly where wide variation in head and capacity are required. Twin suction and discharge ports are cast on the same side and so arranged that external piping is interchangeable for either parallel or series pumping applications. Overall dimensions, 114" L x 29" W x 62" H. Weight 2480 lbs. Now, complete with operating instructions and performance data. F.O.B. Chicago **1495.00**

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Large supply of new labor-saving, economical hydraulic equipment in many types and sizes. Use these positive, highly efficient smooth pressure hydraulics on presses, arbors, lifts, loaders, power control, positioning, brakes, plastic dies, auto fram alignment, etc., etc.

(Item #42)

ITEM #70—Purolator hydraulic oil filter. Permanent element type. 3/8" female pipe thread ports. Capacity 16 gallons per minute. A $13.00 value. Now postpaid **4.95**

ITEM #4—All steel double action hydraulic cylinder. 1 1/8" bore, 2 7/8" stroke. Clevis mounting. Will lift 1000 lbs. with 1000 P.S.I. line pressure. Perfect for positioning and feeding movements. Shpg. wt. 4 lbs. **Postpaid**..... **4.95**

ITEM #127—Double acting hydraulic cylinder, 1" bore, 1" stroke, 1/2" diam. shaft, 1/4" tubing thread ports. Over-all length closed—6 1/2". Clevis mounting at both ends. Perfect for clamping and feeding. **Postpaid** **5.95**

ITEM #33C—Double action hydraulic cylinder, 1 1/2" bore, 4 1/2" stroke. Clevis mountings at both ends. Uses 1/4" pipe fittings. **Postpaid**..... **8.95**

ITEM #16C—Double acting hydraulic cylinder, 1 1/2" bore, 26" stroke. Will lift 1760 lbs. with 1000 PSI line pressure. Weight 8 lbs. A $55.00 value. Now Only, **Postpaid**..... **16.95**

ITEM #103—Double acting hydraulic cylinder, 2 1/2" bore, 17" stroke. Clevis mounting. Will lift 4900 lbs. with 1000 PSI line pressure. 1 1/4" diam. shaft, 3/8" tubing thread ports. Overall length closed 28". Shpg. wt. 11 lbs. F.O.B. Chicago..... **21.50**

ITEM #31C—Double action hydraulic cylinder, 3 1/2" bore, 11" stroke. Aluminum alloy cylinder wall and all steel 1 1/8" piston rod. Clevis mounting at base and shaft. 19 1/2" overall length closed. Will lift 9625 lbs. using 1000 PSI from Logan Heavy Duty Hydraulic Pump. Uses 3/8" tubing fittings. Value $102.00. Shipping wt. 11 lbs. F.O.B. Chicago..... **22.50**

ITEM #6—Double action hydraulic cylinder, 3" bore, 24" stroke, will lift 7070 lbs. with 1000 PSI line pressure. Steel barrel. 1 1/8" stainless steel shaft. Gov't. acq. cost $176.00. Shpg. wt. 26 lbs. F.O.B. Chicago **28.00**

ITEM #42—Double action hydraulic cylinder, 4" bore, 18" stroke. Rated lift capacity with 1000 PSI line pressure is 12,500 lbs. Shpg. wt. 30 lbs. F.O.B. Chicago An Excellent Buy for..... **32.50**

BRAND NEW

(Item #130)

GENERAL MOTORS — ALLISON

CENTRIFUGAL PUMP

200 GALLONS PER MINUTE

• For Draining Basements • Fire-Fighting • Irrigation • Fuel Transfer • Swimming Pools • Home Water Systems • Dewatering

This General Motors-Allison Centrifugal Pump—designed for use on U. S. Air Force Mustang fighters, now converted for commercial, home, and industrial high volume pumping applications. Inlet, 2 1/2" standard pipe thread, twin outlets with 1 1/4" pipe thread, ball bearing supported 3/4" shaft. Easy, fast simple priming. Rotation, counter-clockwise facing shaft. Shipping wt. 35 lbs. Gov't acq. cost $145.00. Now Only **39.50** F.O.B. Chgo.

Suction Lift	Head Pressure	Gal. Per Min.	H.P.	R.P.M.
10'	75'	260	6.0	3500
10'	65'	200	5.2	3500
10'	80'	40	1.5	2500
10'	50'	140	5.0	3500
10'	30'	100	3.0	2500

NEW! STATIONARY OR PORTABLE

D.C. Arc Welder

250 AMPS. MODEL 252 (ITEM #65)

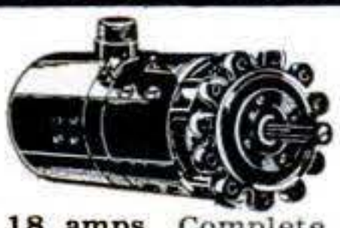
FOR ANY WELDING JOB LIGHT OR HEAVY

STOP COSTLY REPAIR BILLS, WELD IT YOURSELF AND SAVE

Now at a fraction of its value

Only one or two jobs will pay for entire welder. Designed for many years of trouble-free service. This precision-engineered Direct Current ELECTRIC ARC WELDER is offered at but a fraction of its original value. It can be mounted permanently or easily transported for portable use. Does the job instantly where and when you need it. Has dial type rheostat for easy pinpoint control and a high-low range switch. Run welder at 2500 RPM from drive pulley or power take-off of tractor, a 7 1/2 HP electric motor or a 10 HP gas engine. Use two V belts or flat belt (on pulley). Price includes double V or flat belt pulley and instruction book. Shpg. wt. 107 lbs. F.O.B. Chicago **99.50**

DIRECT CURRENT GENERATORS



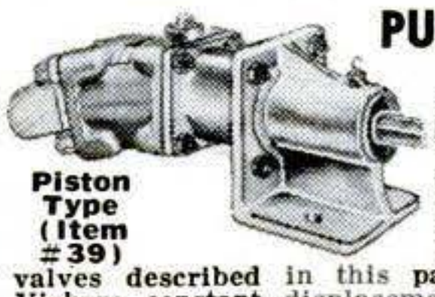
For welders, plating, truck and marine use, D. C. appliances, lights, etc. Aircraft quality—lifetime grease sealed ball bearings. Heavy duty.

Item #131—Brand new Electric Auto-Lite 12 volt Direct Current electric generators, rated 18 amps. Complete with blower and pulley. Use for trucks, tractors, boats, battery chargers, etc. Part No. GEF-4805A. In original sealed U. S. Army cartons. $40.00 value. Shpg. wt. 27 lbs. F.O.B. Chicago. Now Only..... **15.00**

Item #90—Type P-1, rated 200 Amps.—28 Volts, 2500 RPM. Mfd. by General Electric, Ford, Delco-Remy and Westinghouse. Gov't. Acq. Cost $300.00. Shpg. wt. 53 lbs. F.O.B. Chicago..... **22.50**

Item #91—Type R-1, rated 300 Amps.—30 Volts. Mfd. by Jack & Heintz. Gov't. Acq. Cost $380.00. Shpg. wt. 59 lbs. F.O.B. Chicago. Each individually packed in wooden box **35.00**

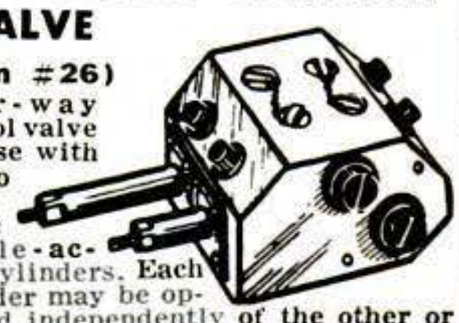
Vickers HYDRAULIC PUMP



Piston Type (Item #39)

Ideal for use with hydraulic cylinders and valves described in this page ad. Vickers constant displacement piston type pump delivers .507 cubic inches per revolution, 8 gallons per minute at 3750 RPM, 1000 PSI. Has 1/2" diam. shaft, 3/4"-18 thread inlet and outlet ports. Rotation—clockwise. Ppd. **19.90**

HYDRAULIC CONTROL VALVE



(Item #26)

Four-way control valve for use with two hydraulic double-action cylinders. Each cylinder may be operated independently of the other or in conjunction with the other. Oil may be locked in any of the cylinders to hold the piston at any required position. Ship. wt. 6 lbs. A $60.00 value. postpaid..... **12.95**

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Most practical tool a man can own—more powerful than any similar tool you can buy. Works well in wood, plastics, and metal. For home maintenance jobs you'll wonder how you got along without it. For model making it's a **must.** And for general shop operations it saves time and money. Compare it, try it, buy it. You be the judge!

CHECK THESE IMPORTANT FEATURES—Oilless sealed bearings • Dynamically balanced armature • Shock-proof, Bakelite housing • Dust-filtered air cooling system • Sturdy 110-120 V., A.C.-D.C. motor • Wt. only 13 oz. •

A precision tool widely used in industry for many years.

MOTO-TOOL NO. 2 (with 1 emery wheel point) **$16.50**

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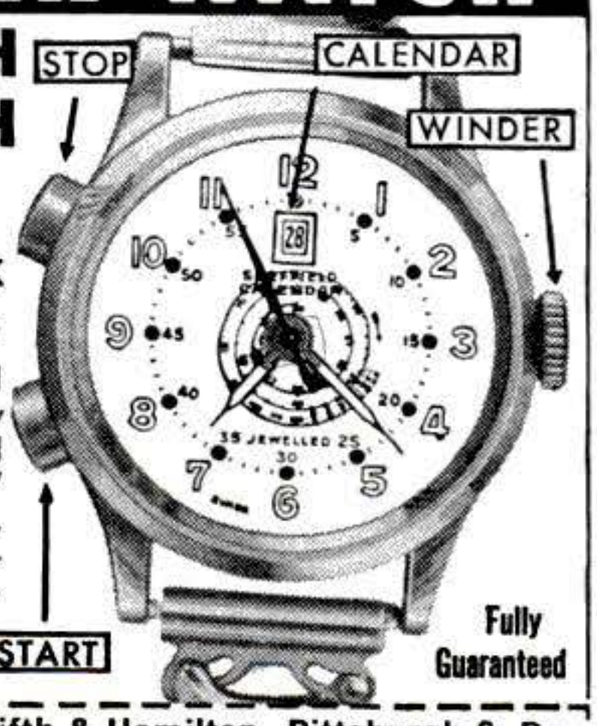

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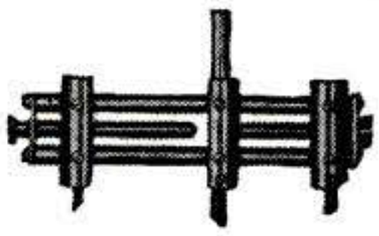

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Vernier adjustment! Lifetime! Heavy, rigid construction!

Capacity	Post. Pd.	Capacity	Post. Pd.
4½" (single bit)	$4	10" (single bit)	$6
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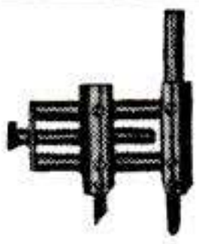

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Gigantic Summer Sale, War Surplus, Excess Inventory Bargains

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Ideal for Model Parts or Shop Work

Mill-Grind-Drill-Index-Route curved or straight-Rabbet and Mortise on drill press or lathe. 8" Table, 4" Cross Feed, 360° Rotation, Accurately Graduated. Bolts to table. Order NOW! SAVE $100. Only **$54.50.** Less Rotary Feed **$43.75.** Write for "HOBB-E" Tool Circular.

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WALL and CEILING PANELS

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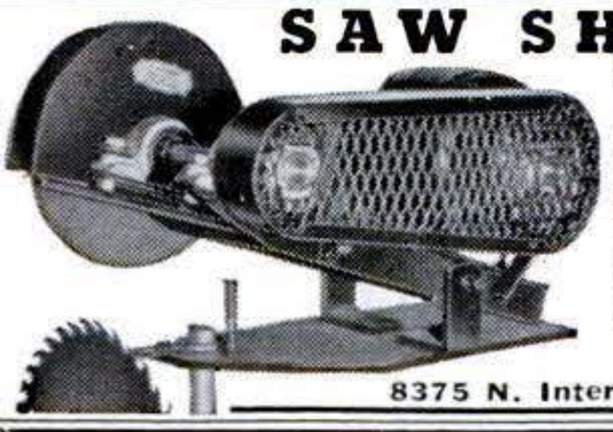

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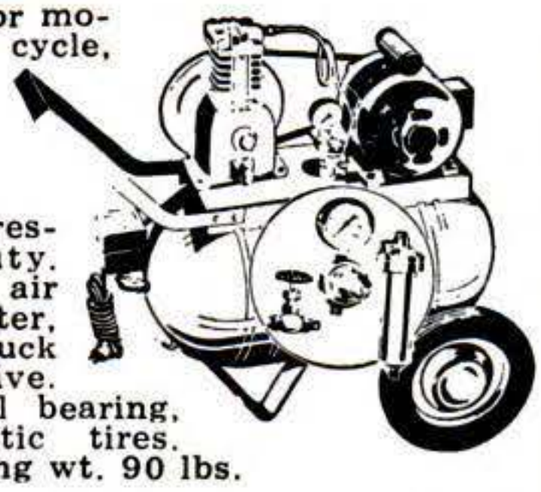

⅓ H.P. heavy duty capacitor motor. AC 110/220 volt, 60 cycle, 2x1¾ inch piston type compressor, splash feed lubrication. 12x24 inch tank, automatic pressure switch. CFM 2.8 at 100 lb. pressure, or 150 lbs. pressure for intermittent duty. Check valve, safety valve, air regulator with gauge and filter, 20 ft. air hose with air chuck for inflating tires. V. belt drive. Mounted on 2 wheels, ball bearing, with 2"x10" semi-pneumatic tires. Portable with handle. Shipping wt. 90 lbs.

With ⅓ h.p. motor **$160 Value.**	**$98.50**	Less Motor.....	**$79.50**
With ½ h.p. motor.....	**$109.50**	With 1½ h.p. gas engine....	**$124.50**
Compressor only.....	**$20.50**	Regulating gauge and filter.....	**$8.95**

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V-Belt clutch, Light Plants, Generators, Gas Engines, Blowers, Portable Electric Saws and Drills.

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WELLWORTH TRADING CO.

1831 S. STATE ST. DEPT. B-8 CHICAGO 16, ILL.

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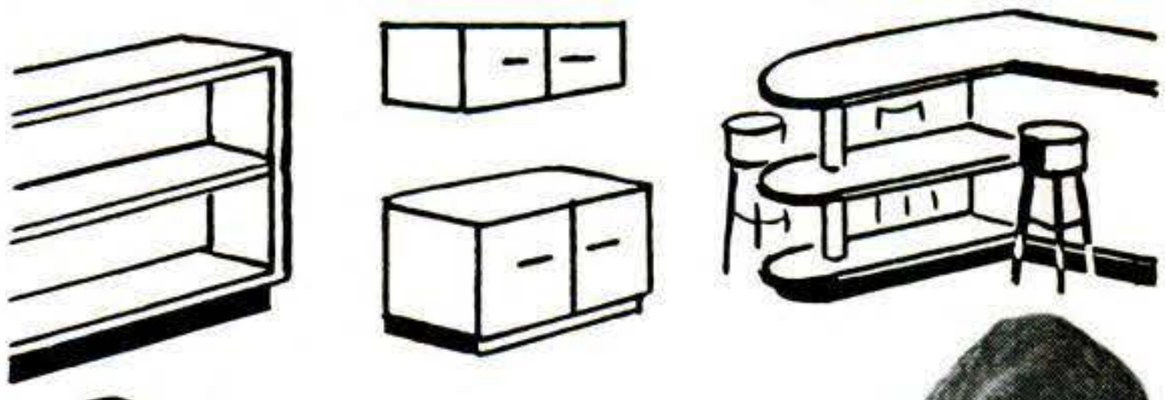

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Whatever you have in mind to add to the comfort and livability of your home, these Power King tools will save you hours of time and many dollars. The 8" Tilt/Arbor saw gives you big cutting capacity at low cost. The new 4" jointer-planer adds that "professional-quality" look to all your projects. New FREE tool catalog — send the coupon.

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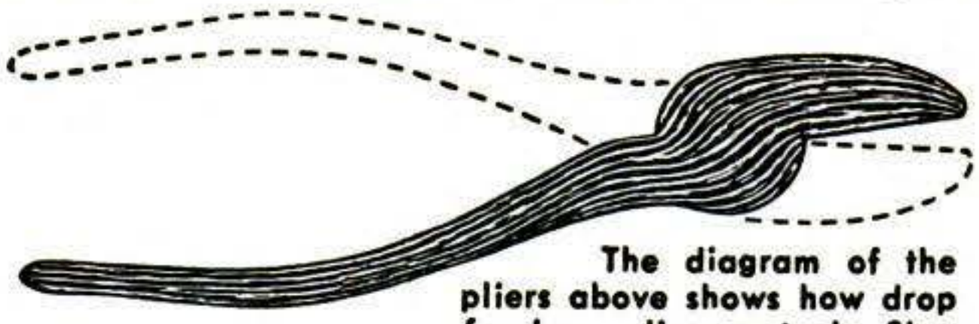
FROM UTICA TOOLS

When you buy tools — pliers and adjustable wrenches — look for the Utica red diamond box and the name "Utica" on the tool. *That means it's skillfully drop forged* — and it means top quality and long service.

DROP FORGED FOR STRENGTH



The diagram of the pliers above shows how drop forging aligns steel fibre structure with shape of tool. This means rugged strength.

CONTRAST THIS WITH

STAMPING

Fibre structure is straight — does not conform to the shape. Fibres are cut off. The tool is relatively weak.

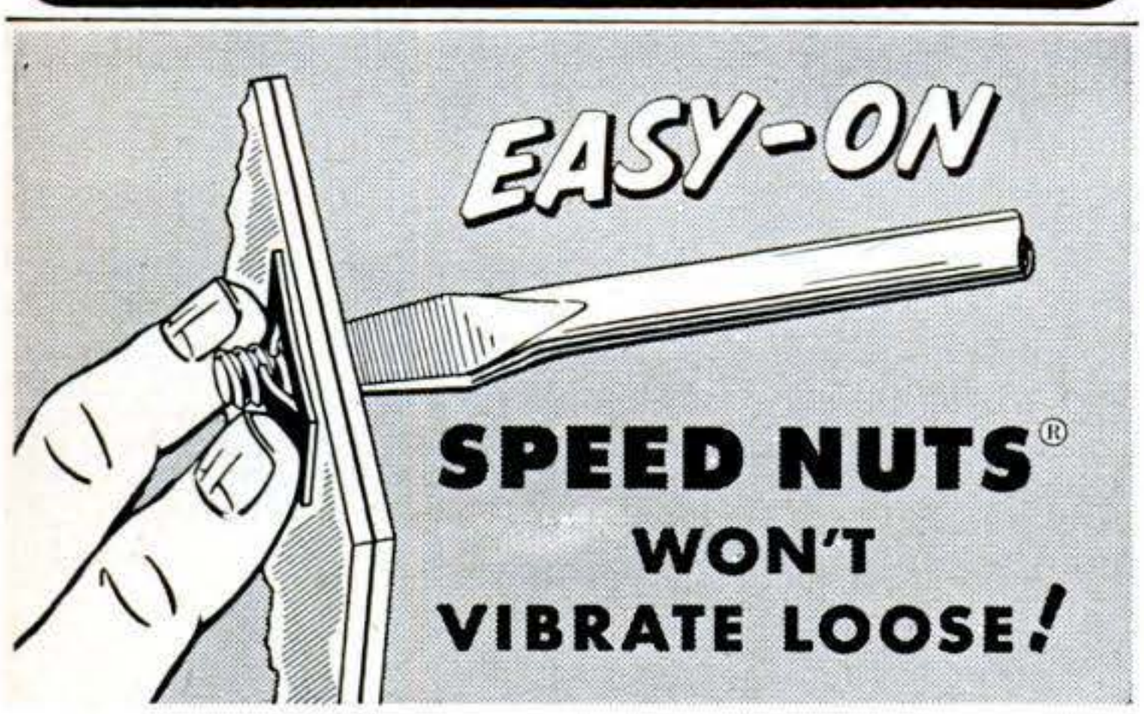
CASTING

Ordinary casting lacks fibre structure for toughness. Relatively very brittle.

U TI CA

DROP FORGE AND TOOL CORPORATION

UTICA 4, NEW YORK



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What Were the Flying Saucers?

[Continued from page 75]

But J. U. Watts, Jr., a Darlington, S. C., lawyer, wrote:

"They are real and man-made. I remember the details as vividly as if they had passed over yesterday . . . One thing is certain, the reports of flying saucers were not mass hysteria or optical illusions. Incidentally, the ones observed by me were not round but oval in shape and moving much as a flying wing might do."

Sees "Classified" Saucer

Some witnesses were tantalizing, like the Air Force sergeant who reported watching a saucer with high-powered binoculars from an airport control tower, then added that he couldn't reveal what he saw because it was classified. Others opened new vistas, like a veteran pilot, Captain Willis Sperry, of American Airlines, who wrote:

"I have talked to just as many pilots who have seen strange occurrences while flying and have not reported it, as have reported the incident. The ones who did not report it feared adverse publicity . . . I flew on the Tokyo airlift last fall and several P.A.A. pilots have seen unexplained objects far from land—one near Australia, several between the mainland of California and Hawaii, and two that I talked to out there said they saw an object close enough so they could describe it in some detail . . ."

Rules Out Unearthly Visitors

One of the most convincing accounts came from a professor of meteorology. After observing that most reports were probably of commonplace objects, he added:

"There remain a few observations by reliable individuals which are not so easily disposed of. I believe my own observation falls into this category . . . the most probable explanation is that they are some sort of guided missile being developed by our armed forces. It seems . . . incredible that they could have come from another planet, especially in view of our knowledge of physical conditions on the other planets."

He ought to know. He's a specialist on the atmospheres of the planets.

Perhaps the last word should go to a North Dakota doctor. "I am afraid you will have to put me down in another column marked 'just dumfounded.' Sometimes I wish I had not seen the fool things at all."

END

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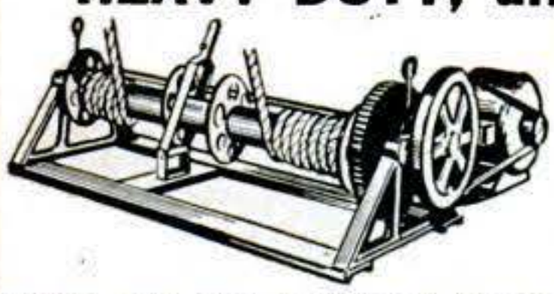

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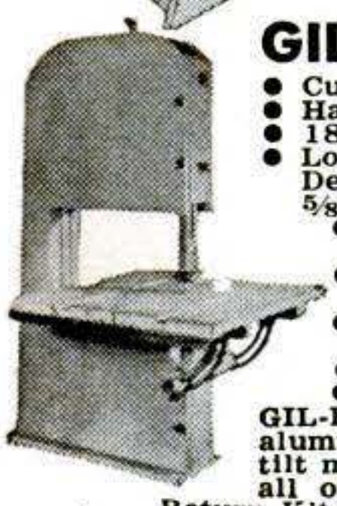
GIL-BILT 10-INCH TILTING ARBOR SAW

- 27x28 in. table, 13½ in. capacity in front of blade
- 10 in. blade cuts 3¼ in. deep, tilts full 45 degrees
- Floor model 34" high, table always stays level
- New Departure ball bearing arbor, ¾" precision shaft turned down for ⅝" bore blades, alum. housing, shipped ready to run
- Jackscrew and 4½ in. dia. handwheel lowers and raises blade
- Cast aluminum miter gauge and self-aligning rip fence guide

GIL-BILT Metal Parts Kit includes Plans, ball bearing arbor, miter gauge and bar, rip fence guide, dado insert, lock knobs, jack screw mechanism and handwheel, and all other metal parts (less blade) **$20.95**
Same Kit with 10" Combination Blade **$24.90**
Same Kit with 8" Combination Blade **$23.90**

GIL-BILT 12-INCH BAND SAW



- Cuts to center of 24 inch circle
- Handles stock up to 6 inch thick
- 18x18 inch table tilts 45 degrees
- Lower wheel and drive pulley runs on sealed New Departure Ball Bearings; Upper wheel runs on two ⅝" bore Oilite Bronze bearings
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GILLIOM POWER TOOLS P. O. Box 1-VH, Lambert Field St. Louis 21, Missouri

Highballing World's Fastest Train

[Continued from page 81]

Art Franke. A fresh road foreman of engines, J. C. Kuschel, followed the fireman through the door. It was 10:22. The roadbed would be double-tracked again.

"Clear block!" sang the fireman.

"Clear!"

We gathered speed. On our left the Mississippi swept like a scimitar toward the tracks.

It was 10:55½ when we stopped at East Dubuque, Ill. The fireman disappeared to inspect his Diesels.

The Chant of Signals Goes on

We were out of East Dubuque on the dot at 10:59. Our schedule called for us to roll into Prairie du Chien at 11:38.

"Green board!"

"Green board!"

The locomotive throbbed. The speedometer needle marched up to 90.

"Clear block!"

"Clear block!"

"Boy!" said Fireman Franke in the next breath. "He had a nice mess of fish!"

At our speed, I'd missed a fisherman on the riverbank.

"Yellow board!"

"Yellow board!"

It was 11:23. The engineer closed his throttle. The speedometer needle swung back over the face of its dial.

"Here she comes!" called the fireman.

The southbound Zephyr bore down on us on the companion track and roared by.

"A Little Slow Today!"

It was 11:28 before we were back to 90 miles an hour. As we slowed to pass the Crawford tower outside Prairie du Chien, Engineer Kerrigan looked at his watch and shook his head. It was 11:39 when we rolled to a stop. Our speed from East Dubuque had been 81.6 miles an hour.

At North La Crosse the train changed crews again. I climbed down from the cab.

"Little slow today!" boomed Engineer Kerrigan, knocking out his pipe on the heel of his hand as we walked toward the division superintendent's office. "Little slow!"

The Zephyr's Diesels began barking as the throttle came open. The train gathered speed. In an hour and 59 minutes it would be in St. Paul, 128 miles away. END

Next Month: Building the world's biggest little railroad.

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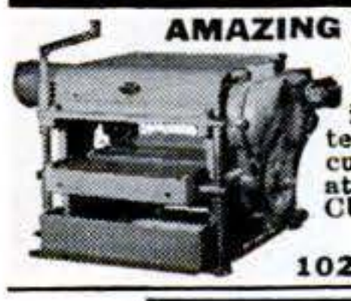

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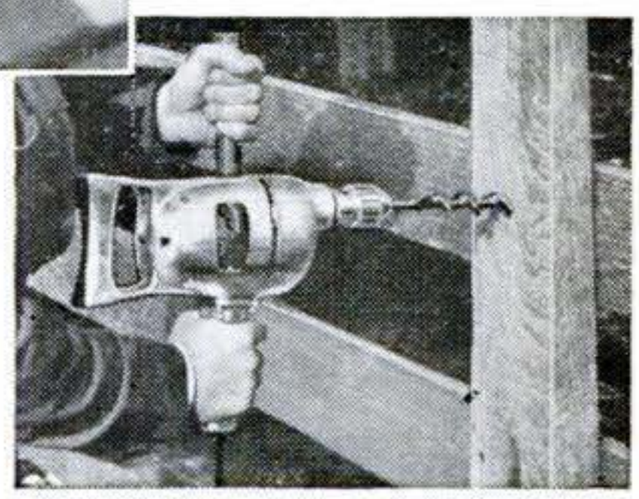

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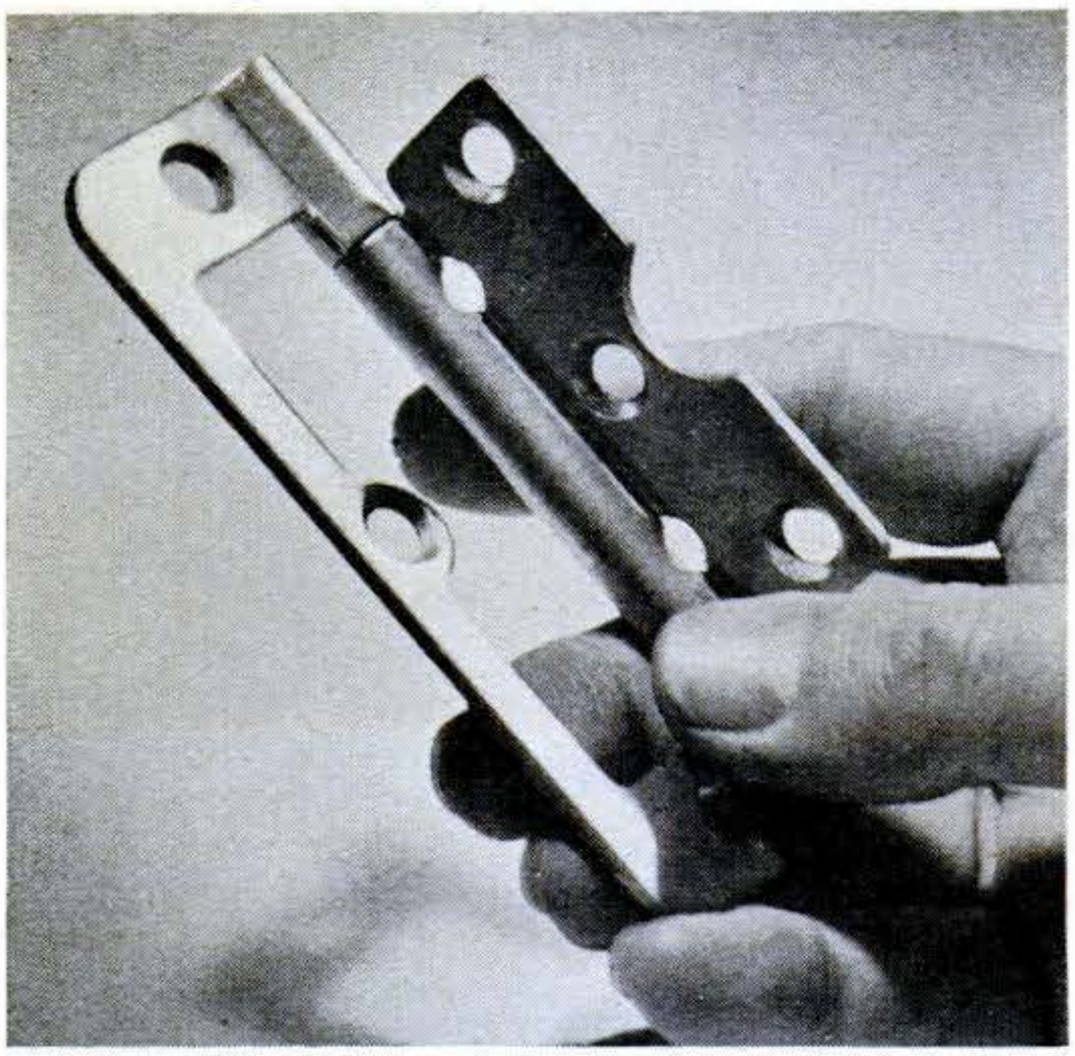
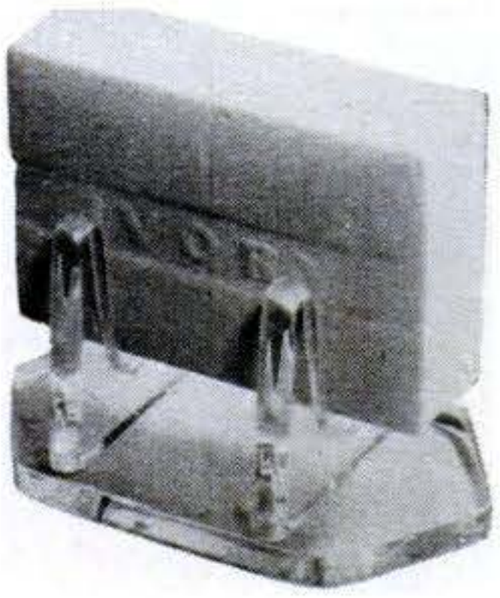
New Hinge Simplifies Door Hanging

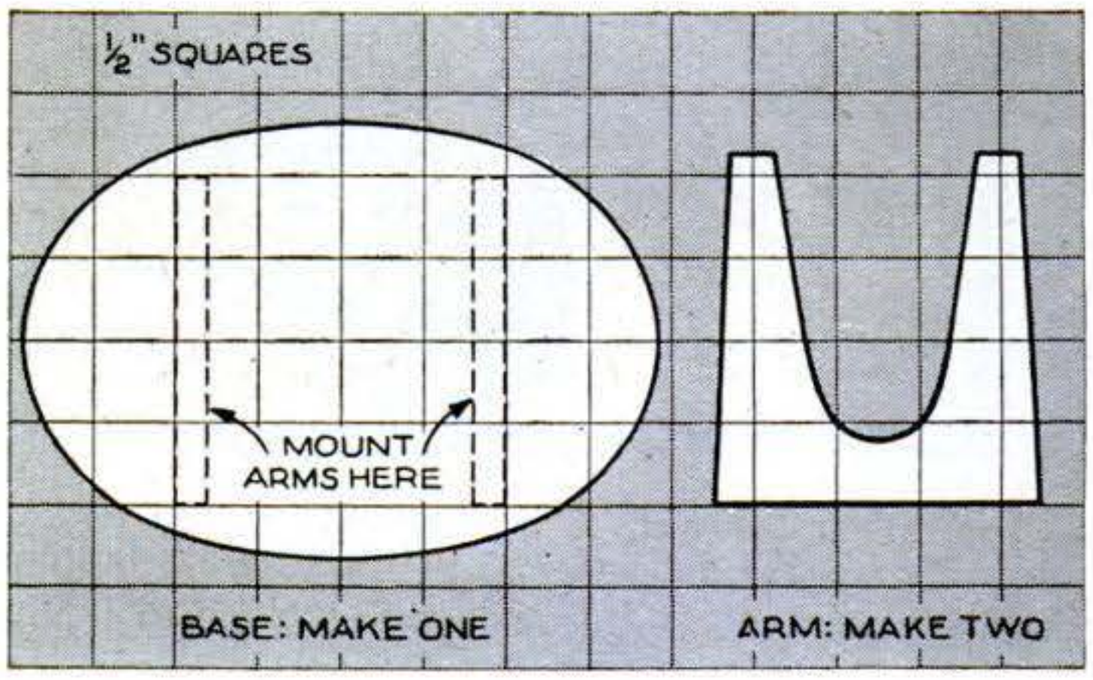


JUST screw a set of these English-made hinges to a door and to the jamb and the job is done. The most time-consuming job of door hanging—recessing door and jamb for the hinge leaves—is eliminated. Recesses are unnecessary because the smaller leaf fits inside the larger one when the door is closed. Sizes run from 1½" to 4". Hurlinge hinges are distributed by Cindico, Inc., of New York City.

Stand Holds Soap Upright



SOAP lasts longer when kept in a holder that allows it to drain dry. I made this one of Lucite, but any ¼" plastic would do. Trace and saw the outlines carefully. Sand and buff the edges. If you don't have a buffing wheel, use toothpaste and a heavy cloth pad. Assemble the parts with plastic solvent or household cement.—*William King, New York City.*



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These H.S. precision drills with 1/2" shanks can be used in a 1/2" electric drill or a 1/2" capacity lathe or drill press.

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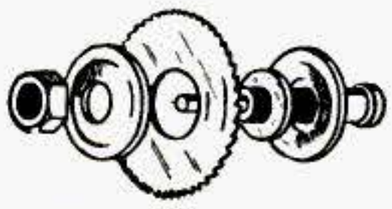

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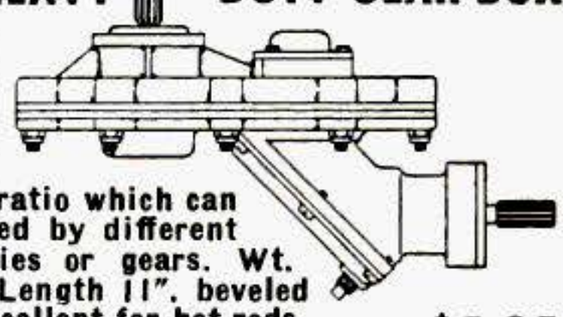

Ball-bearing throughout with 1/2" drive spline, 1:1 gear ratio which can be changed by different size pullies or gears. Wt. 5 1/2 lbs. Length 11". beveled gears. Excellent for hot rods, power mowers, etc. Only..... **$5.95**

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All parts available—Kit or separately.

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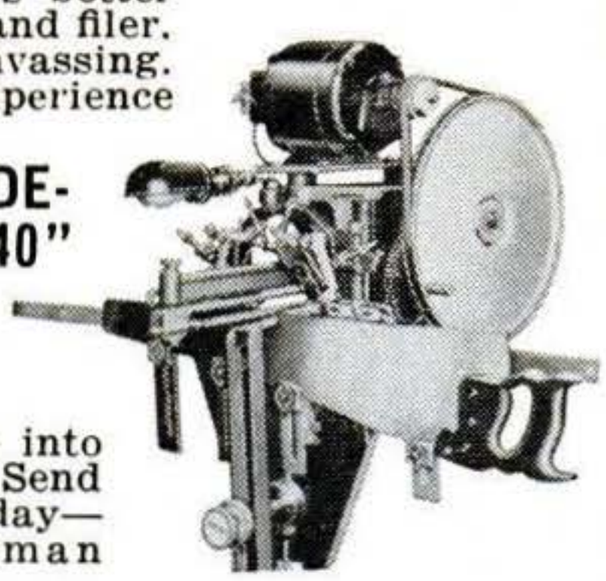
Make up to $2 or $3 an hour in Spare Time. With a Foley Automatic Saw Filer you can file hand, band and circular saws better than the most expert hand filer. Cash business—no canvassing. No eyestrain, no experience needed.



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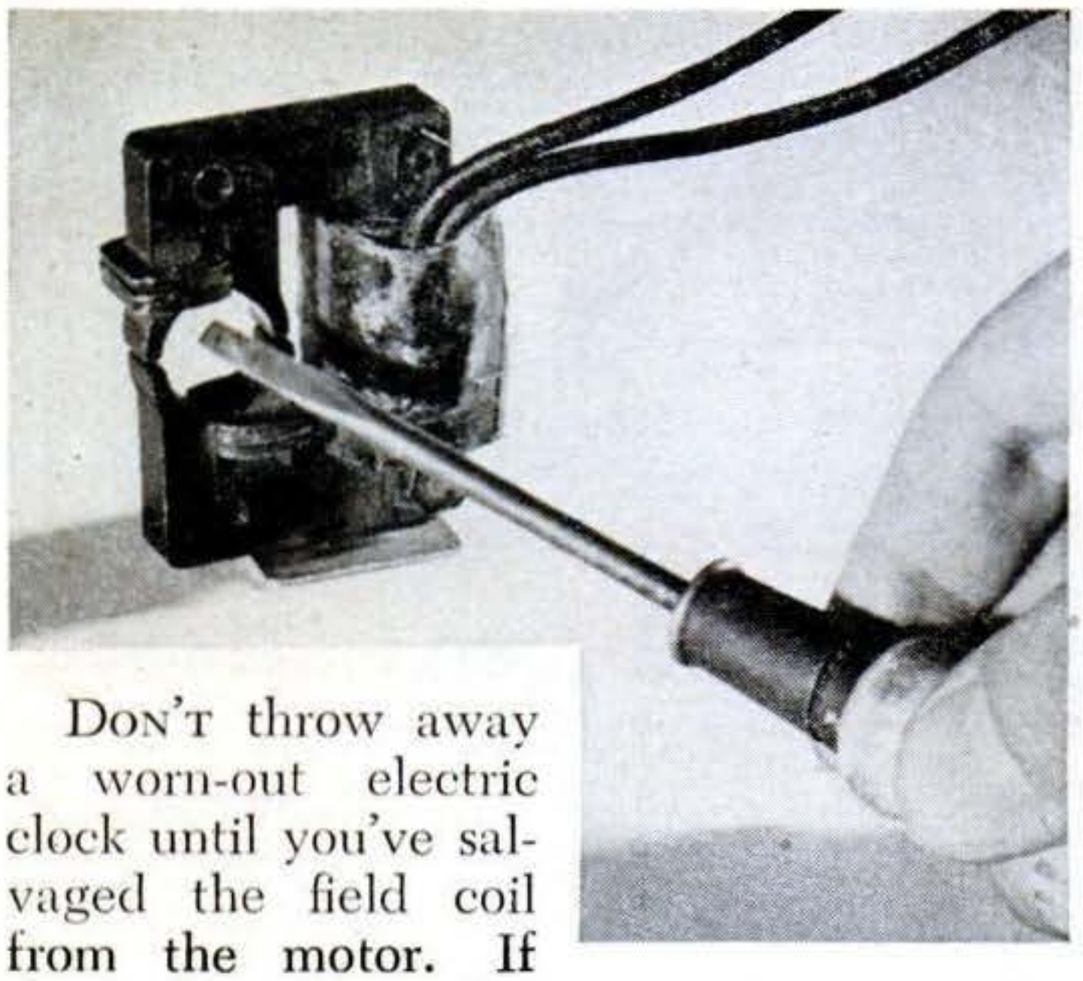
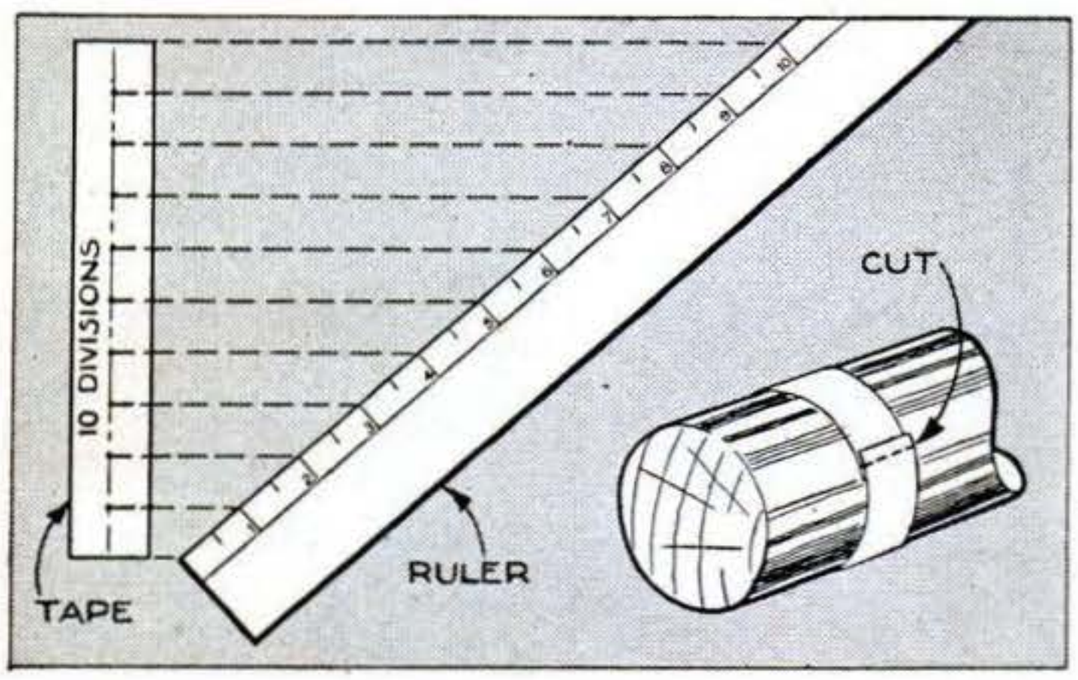
AIRBORNE SALES CO., INC. DEPT. PSM 8-51 CULVER CITY, CALIF

Clock Coil Demagnetizes Small Tools



Don't throw away a worn-out electric clock until you've salvaged the field coil from the motor. If the coil's still good, you can use it to demagnetize screwdrivers and other small tools that tend to pick up filings. Splice on enough wire to reach an AC outlet and tape the leads. Plug in the coil and insert the tool to be demagnetized in the coil opening. Rotate it to the left and then right for a second and draw it away slowly while the current is on.—*Arthur F. Yaw, Seeley, Calif.*

Ruler Trick Divides Circumference



Two familiar dodges can be combined to divide the circumference of a tube, rod or pipe into any number of equal parts.

Wrap a piece of masking tape around the piece, overlapping the ends. Cut squarely through the lap with a razor, and remove the tape, being careful not to stretch it.

Stick the tape vertically on a piece of paper and draw a line down the center. With a T square, draw horizontal lines from its top and bottom. Then lay a ruler across these lines with the desired number of ruler divisions spanning them. Mark off the ruler divisions, then, with the T square, run a line from each division to the tape. Again wrap the tape around the piece to be divided, and prick-punch the marks.

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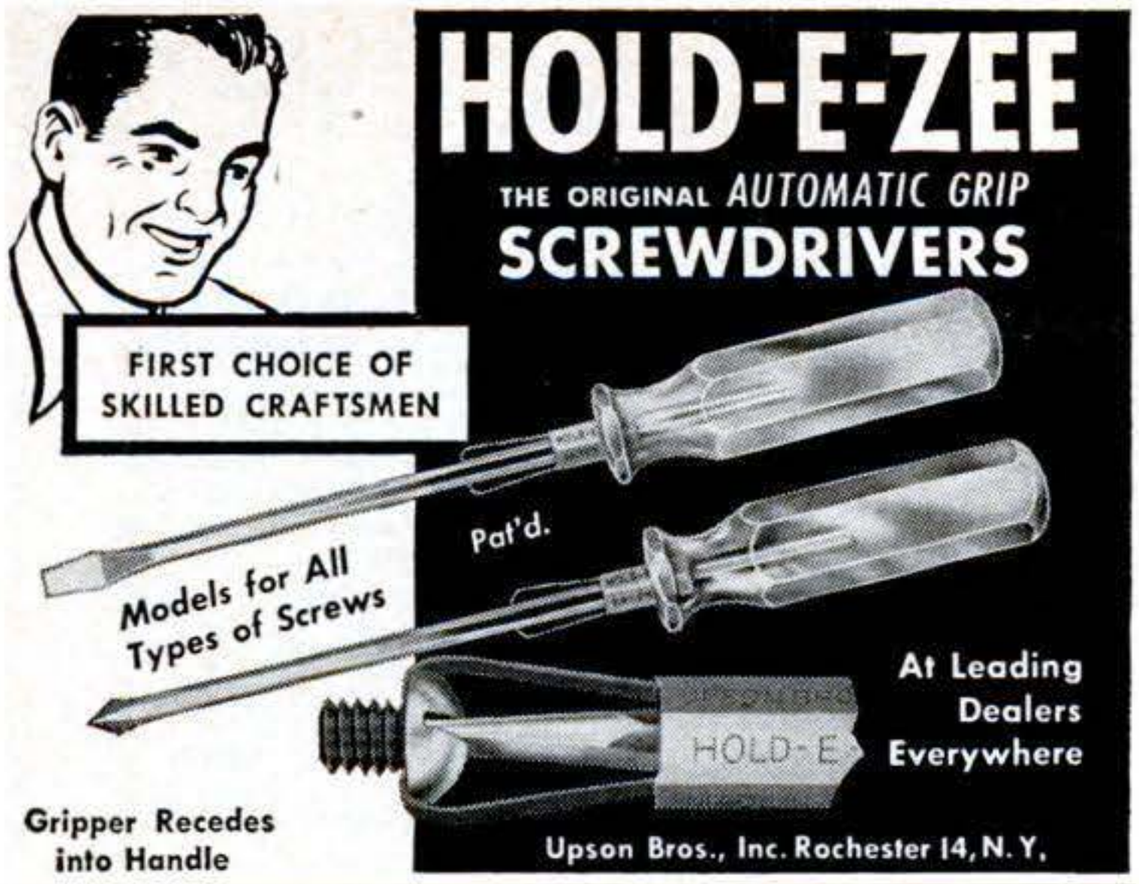

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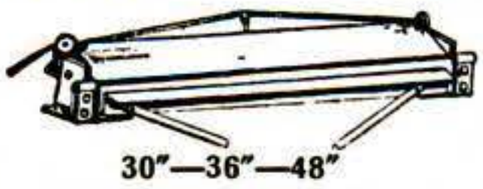

24" CURVE FORMER, 2 roll, 16 gauge, 2" to 2' dia...**$10.00 P.P.**
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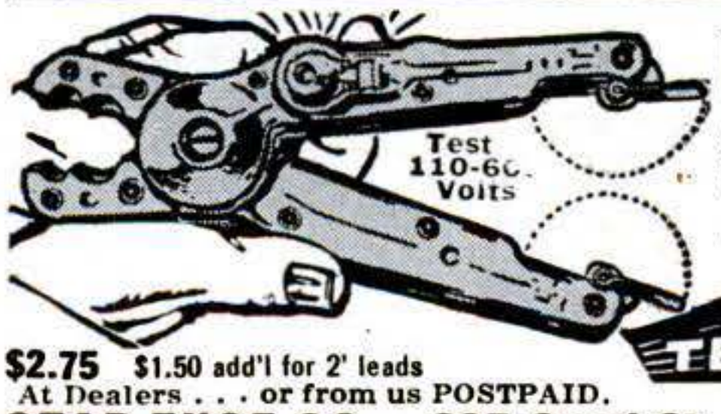

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Throw away the screw caps to your small parts jars and put up the Jiffi-Klip shop shelf on flat wall or between 16" c.c studs. Store rivets, washers, nails, etc., in your shop. SNAP! The jar slips into its clip under the shelf — SNAP! Out it comes with contents clean and ready to use without bothering to remove a useless screw cap. We don't sell the jars, you probably have dozens of them in your shop now.

Sample sent for **79c** plus postage
3 sent prepaid for **$2**

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POWER LAWN MOWER
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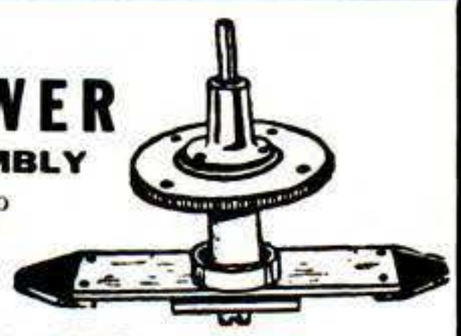

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ATLAS EQUIPMENT Co., Dept. SP-8
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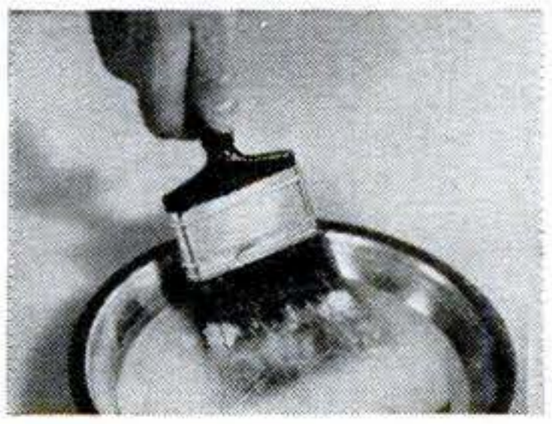
POINTERS FOR HOME PAINTERS

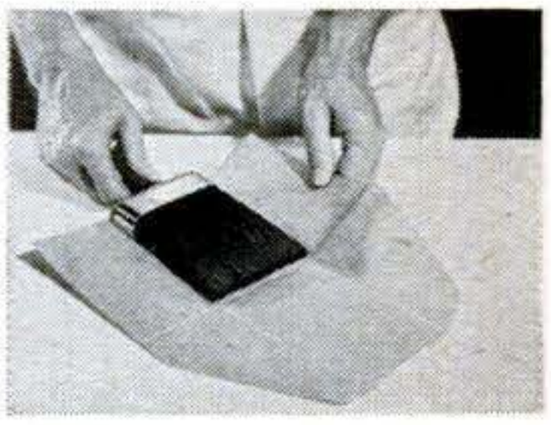
How to get smoother paint jobs . . . longer service from brushes

When finishing rough surfaces, work in the first coat to cover all cavities. Then brush the second coat on with smooth, even strokes.

Apply varnish and enamel finishes with a full brush, allowing the paint to flow on. Always use as few strokes as possible for the job.



Clean brushes in thinner after daily use. Suspend brush in thinner overnight. Bristle tips should not touch bottom of can. Work out thinner before painting again.



When you store brushes for long periods, clean thoroughly and wrap securely in manner shown here. Brushes stay in better condition when they're kept in shape.

For best results use NYLON PAINT BRUSHES

Job after job, you'll get best results with a well-tipped nylon paint brush. Durable Du Pont nylon bristles don't break off, even on roughest surfaces. They last 3 to 5 times longer than ordinary bristles . . . paint smoother . . . are clean and sanitary. Nylon paint brushes are made by leading manufacturers in all types and sizes. Look for the word NYLON on the handle.

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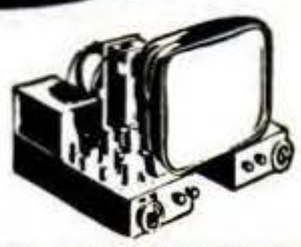

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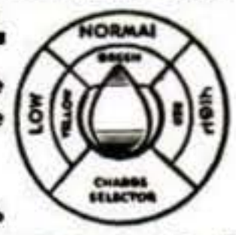

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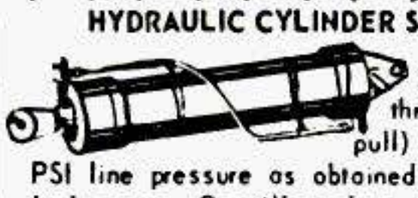
HYDRAULIC CYLINDER SPECIAL



Gives 20,000 lb. thrust (push pull) using 1500 PSI line pressure as obtained from our hyd. pumps. Or will produce 40,000 lb. thrust with 3,000 lb. line pressure. CAN ALSO BE OPERATED ON LOW PRESSURE AIR SYSTEMS. 4" Bore, 1½" dia. piston shaft, 18" stroke, length 30½". Equipped with ball bearing loaded clevis type mounting and swivel type high pressure steel pipe bracket for easy use. Ideal for road, farm & shop machinery, presses, etc. Cost Gov't $390.00 **29.95**

We carry the World's Largest Supply of Special Hydraulic Equipment featuring over 20,000 Cylinders in 61 Sizes and Types. Can also supply all accessories such as Pumps, Valves, Tanks, Hose and Fittings. Write for information.

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Double action. Bore is 1". Shaft ½". Has a stroke of 2½" to 4". Stroke can be adjusted with internal sleeve stops. Overall length is 8½". Will take 1500 lbs. continuous duty. 3000 lbs. intermittent. Will lift or push to 1100 lbs. **5.75**

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Poppet type. Valve shuts off at neutral position. Has 3/8" A.C. Tube Ports – 9/16 – 20 thread. Will stand 1500 PSI **6.75**

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With built-in variable flow control valve in head. Positive displacement piston type. displaces .450 cu. in. per revolution. 2 gal. per. min. cap. at 1500 RPM at 1250 PSI. Pressure limit, 1250 PSI continuous, 1400 PSI for 15 sec. Operates at 3750 RPM, intermittent maximum 4500 RPM. Rotates either direction without adjustment **19.50**

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Logan Geroter type. For operating hydraulic systems on trucks, tractors, etc. Delivers 8 GPM at 1200 RPM at 1000 PSI with 5 H.P. Can also be used as Hydraulic fluid motor. 3/8" std. pipe ports, 1/2" splined shaft for pulley or direct attachment. 5½" dia., 7" long. Used but condition guaranteed. **19.50**

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1951 CATALOG

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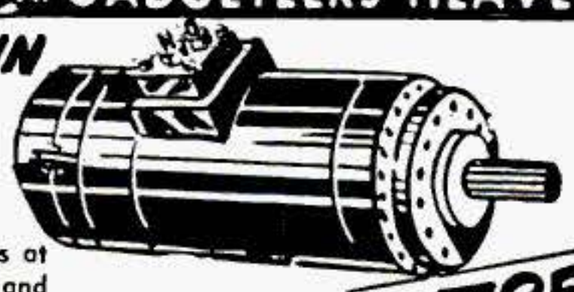

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VICKERS HYDRAULIC Transmission

VT-1

Self contained, 2 H.P., constant torque at all speeds with variable volume reversible, piston pump (controlled by outside lever) supplying piston hydraulic motor. Automatic pressure, dash pot for smooth control. Power output RPM –0 to 1/3 input RPM in both directions. Input RPM 1800 continuous. 4000 intermittent. Dash pot can be removed for greater RPM. Ideal for lathes, duplicator set-up on mills, conveyors, small cars, drives, gearings, etc. **32.50**

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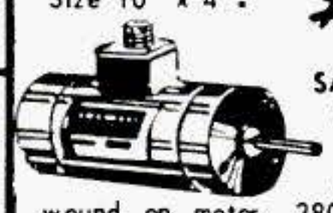

SAMSELL MOTOR 27 volts, 16 amps 1/5 H.P. reversible, series wound on motor. 3800 R.P.M., shaft 9/32" diameter. 12-spline. 4-1/8" x 2-3/8". ONLY **3.95**

GEAR HEAD MOTOR Heavy Duty G.E. Gear Head Motor. 1½ H.P., 24 volt DC, 125 amp reversible motor will drive reduction gear box unit 44.5 to 1, resulting in 168 R.P.M. at 5/8" diameter take-off shaft. Motor contains electro magnetic break.

UNIT COMPLETE **10.95** MOTOR **4.95**

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Overall Width	Length	Price ea.
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ATTENTION GADGETEERS

Electric GYRO

Turns up to 50,000 R.P.M. Electric drive motor is integral part of balance wheel. Has double end shafts to drive precision tools or machinery at precise, controlled speeds. Full ball bearing mounted. Operates high or low voltage A highly precise instrument, ideal for experimental work, science labs, hobbyists, & technical engineers. A tremendous buy **4.95**

HI-SPEED TAPS

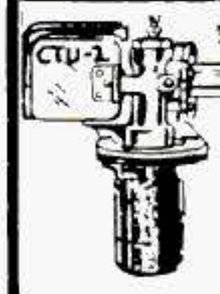
DEFENSE PLANT SURPLUS
Slightly used but perfect.

1/4-20	26¢	7/16-14	39¢
5/16-18	29¢	1/2-13	47¢
3/18-16	33¢	5/8-18	66¢
PIPE TAPS			
1/8-	48¢	1/2	$1.32
3/8	69¢	3/4	$1.83

Attention Shop Owners, Defense Plants, etc. We carry $1,500,000 stock of machine tools such as Taps, Dies, Cutters, Reamers, etc. SEND FOR CATALOG TODAY

GEAR BOX – VTG-1 – 90° – bevel gear 1½ to 1 reduction. A lifetime value **3.95**
Size: 7" x 6" . . .

Has lever control for engaging & disengaging positive clutch. Dust proof housing, pre-lubricated bearings . . . Can be adapted to Vickers Transmission.



Electric ACTUATOR

Hundreds of uses for any mechanical device needing controlled 2-way action. Opens, closes, raises or lowers doors, windows, gates, valves.

CTU-2 Foote linear actuator. 24 Volt, A.C. or D.C., 8500 R.P.M., 1/6 H.P. – Series wound motor. 4½" stroke in 13½ seconds. Compression and tension loads up to 750 lbs. Adjustable micro-switch for limits of travel. Overall length retracted 11" **6.95**

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This is really **TWO IRONS in ONE!!** A control button in handle selects 150 or 300 watt heat. Full size iron for light & hvy work. Removable, solid copper tip. Complete with cord & tip. **4.95**

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Any above ammeters. **3.95**

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COMBINATION VOLT AMMETERS
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ABOVE AMMETERS HAVE 2" FACE EXCEPT 0-300 WHICH HAS 3" FACE

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IT IS NECESSARY TO USE SHUNTS WITH ALL D.C. AMMETERS

30-A 60-A 120-A
150-A 240-A 300-A **1.25**

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GADGET MIX – Rivets, Spacers, Bolts, Screws, Gears, Wheel bearings, Springs and Clamps. No. 106, 5 lbs. **1.19**

BEARING MIX. No. 170A. Approx. 20 needle, Ball & Roller Bearings, New & Used. Sizes: 1/2" to 4". Some of these cost Gov't $10 a piece. Never such a value! 5 lbs. **ONLY** **1.59**

HINGE MIX, No. 170H. 12 pairs of Strap and butt hinges, Hasps, 1" x 1" to 7/8" x 10" in length and 8" strap. 2 lbs. **1.09**

ABRASIVE AND GRINDING WHEEL MIX – 50 pieces including honing stone, pencil rolls, wheels, etc. A sharp value. No. 170AG **99c**

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RIVET MIX – 3 POUNDS – Consisting of sizes from 1/4" to 3" long in many diameters & alloys. **1.19**

FILE MIX – Ten assorted Files – 4" to 12". Includes Vixens, half rounds, mills, bastards, etc. – in seconds and used but good condition. 1 Vixen alone is worth our price for entire mix. . . **99¢**

PULLEY MIX – You'll want this one around. 10 micarta & metal pulleys ranging from 1" to 5" with ball and one piece bearings. These are aircraft pulleys, the best made – with hundreds of uses. A WONDERFUL BUY! **2.95**

SCREW MIX – 5 lbs., Including assortment of wood and machine screws. Many sizes. Save dollars and alway have plenty of screws on hand. . **1.39**

NUT MIX NM-1 – 3 lbs. approx. 500 nut. Anchor, Lock, Castle, Hex, Elastic Stop Nuts, etc. You'll always have plenty of Nuts in the shop. NM-1 **1.39**

SUPER COMBO MIX – No. SC2. Here's a real bargain. All ten above mixes for **ONLY** **12.95**

AIRCRAFT CABLE

Rust resistant, alloyed steel. Extra flexible. Pre-formed, 7 x 19 strand. On reels.

1/16"	4½¢ ft.	3/16"	9½¢ ft.
5/64"	5¢ ft.	7/32"	10½¢ ft.
3/32"	5½¢ ft.	1/4"	12½¢ ft.
1/8"	7¢ ft.	9/32"	15¢ ft.
5/32"	7½¢ ft.	5/16"	16½¢ ft.
1/2"	20¢ ft.	3/8"	18¢ ft.

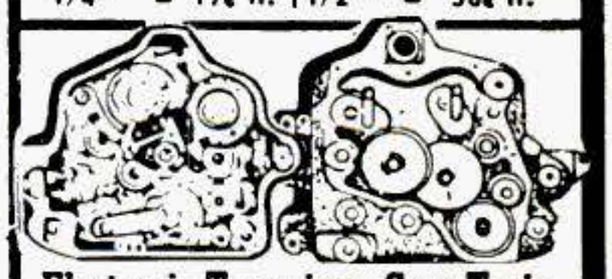
Special! 3/16" cable, 18 ft. long with turnbuckle ends . . . . . **99¢**

Stainless Steel Cable – Pre-formed

1/16"	6¢ ft.	5/32"	20¢ ft.
3/32"	14¢ ft.	1/4"	26¢ ft.

Bronze Cable – Not Pre-formed

1/16"	5¢ ft.	3/16"	23¢ ft.
1/4"	17¢ ft.	1/2"	38¢ ft.



Electronic Trnsmissn. Gear Train

GT-1 – approx. 50 Bronze Spur & Pinion Gears, 3/8" to 4" dia., 5 sets of 7 cluster gears, 2 complete worm and worm gear drive sets, 40 N.D. ball bearings ½" to 1½" dia., watch springs, bushings, posts, face plates, housings, micro switches 2 miniature controlled clutches, etc. . . Gears in multiple size and sequence identical teeth ratio, giving 100's of gear reduction combinations. Wt. 19 lbs. **8.49**

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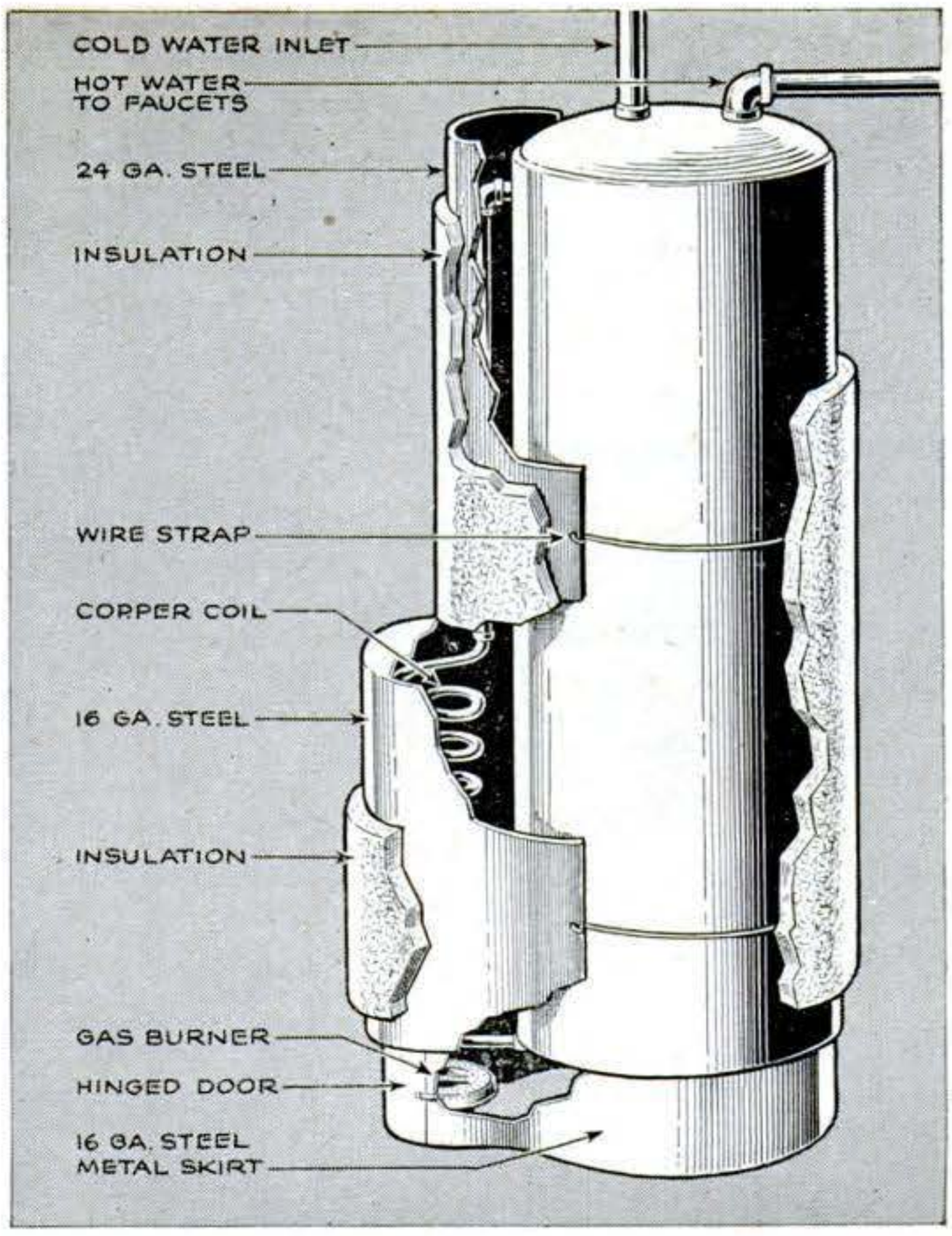
Insulated Casing Improves Side-Arm Water Heater

HERE'S a way you can make an old side-arm water heater much more efficient. I improved mine in the way shown at right several years ago and it's still giving good service.

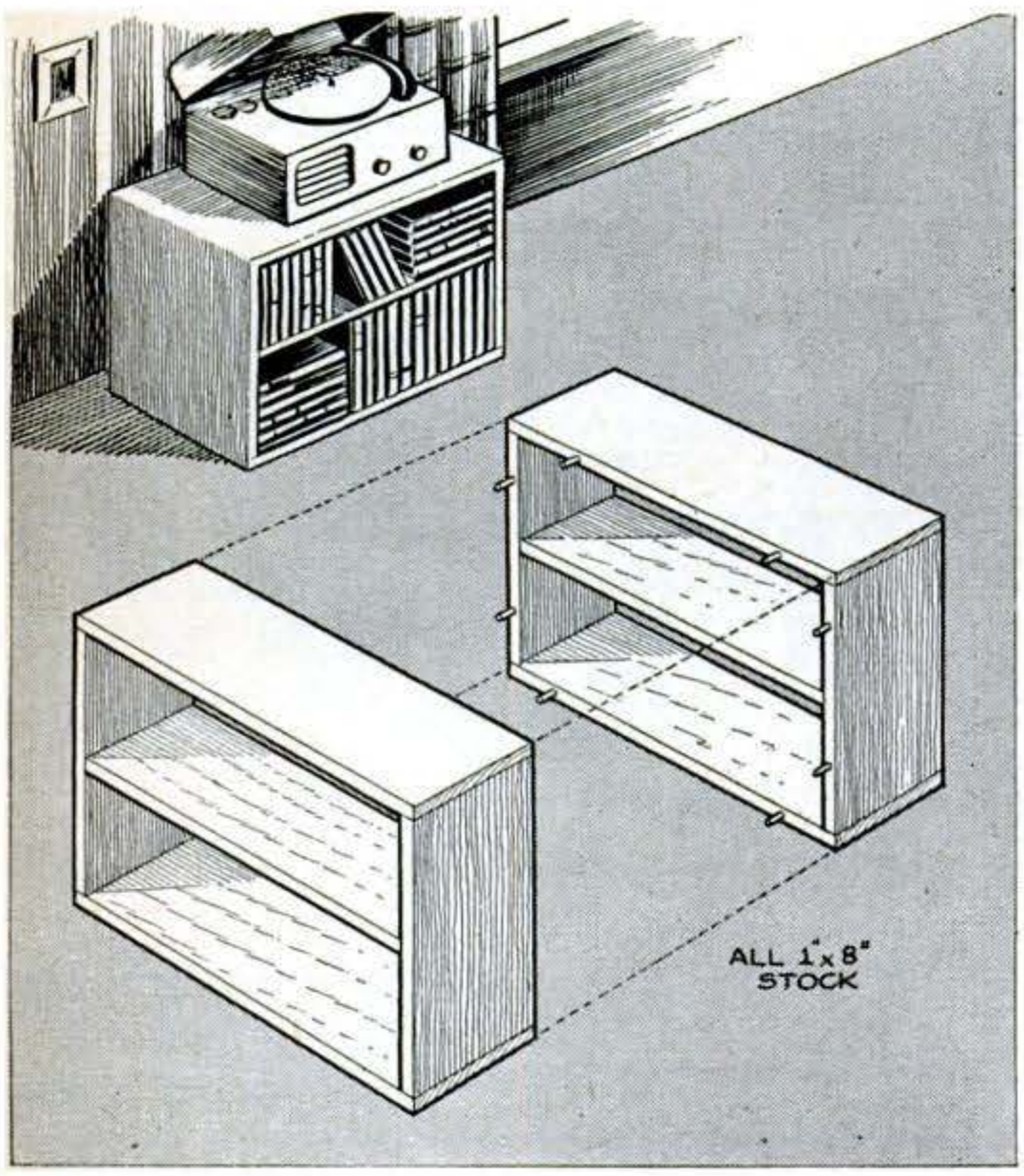
Discarding the original cast-iron shell that surrounded the gas burner and copper coil, I remounted the coil as close as possible to the storage tank. Then I formed a 16-gauge steel shell around the coil and fastened it to the tank with two straps. At the bottom I placed a metal skirt around the tank and coil shell so heat from the burner would warm the base of the tank. A hinged door in the front of the skirt gives access to the gas burner.

The outlet from the coil was placed close to the tank and enclosed by a 24-gauge steel casing, also strapped to the tank. As the hot gases rise through this stack, the hot-water delivery pipe is kept hot. Insulating sheets wrapped around the entire assembly cut the heat loss down to a minimum.—*O. Bogert, Maplewood, N. J.*

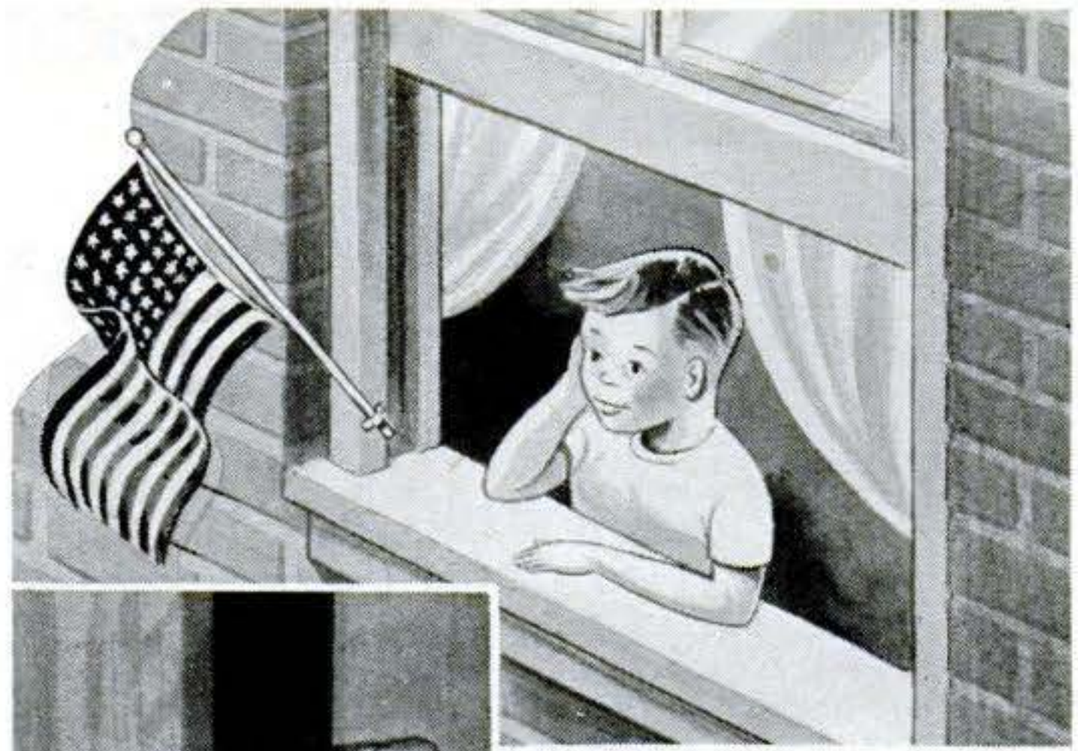


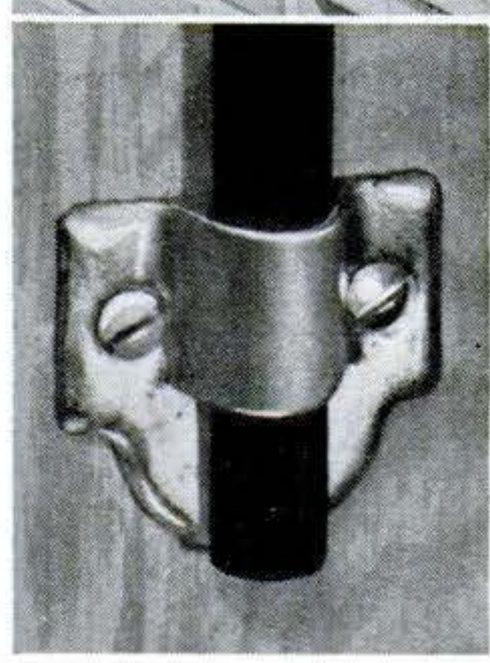
Deep Cabinet Made of Narrow Lumber

I NEEDED a small record cabinet but didn't want to buy a costly 4′ by 8′ plywood panel to make it out of. So I built two identical units from cheap 1″ by 8″ lumber as shown. Then I doweled and glued them edge-to-edge as shown below to get the necessary depth.—*George Warren, New York City.*



Barrel Bolt Is Simple Flag Holder





THE socket of a barrel bolt, attached to a window frame, porch post, or other wood surface, makes a convenient holder for a small flag. Whittle down the end of the stick so that it fits into the metal collar as shown at left above. The eye plate of a large hasp will hold a larger flag stick.—*John J. Rea, Urbana, Ill.*

Race Horses Shod for Speed

WHEN the ponies run at the track, most of them sport lightweight aluminum shoes.

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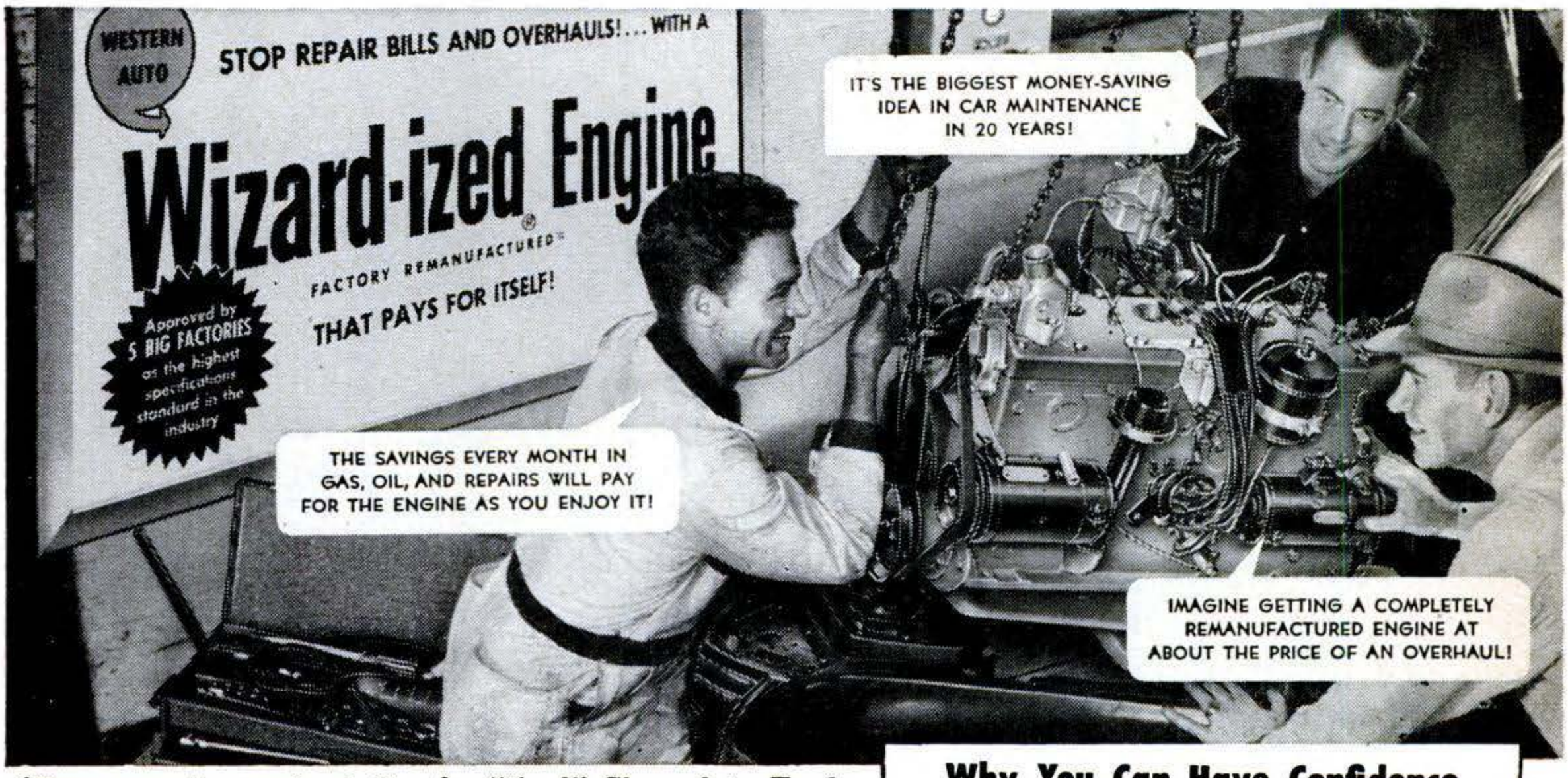
(TERMS VARY BY AREA AND MAKE OF CAR)



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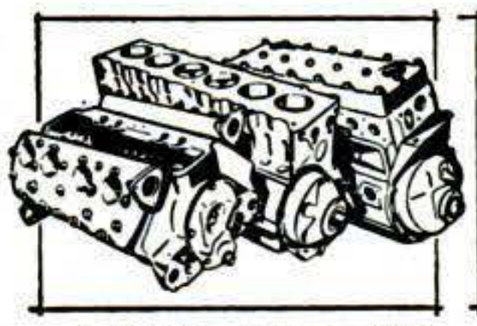

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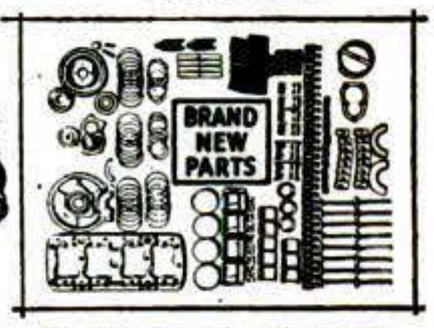

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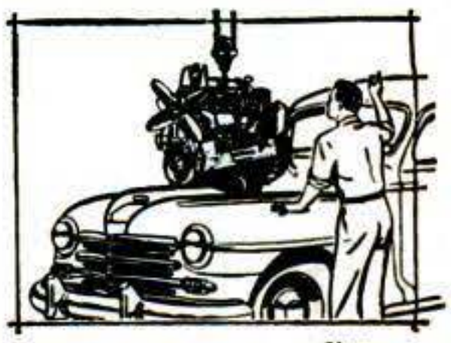

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